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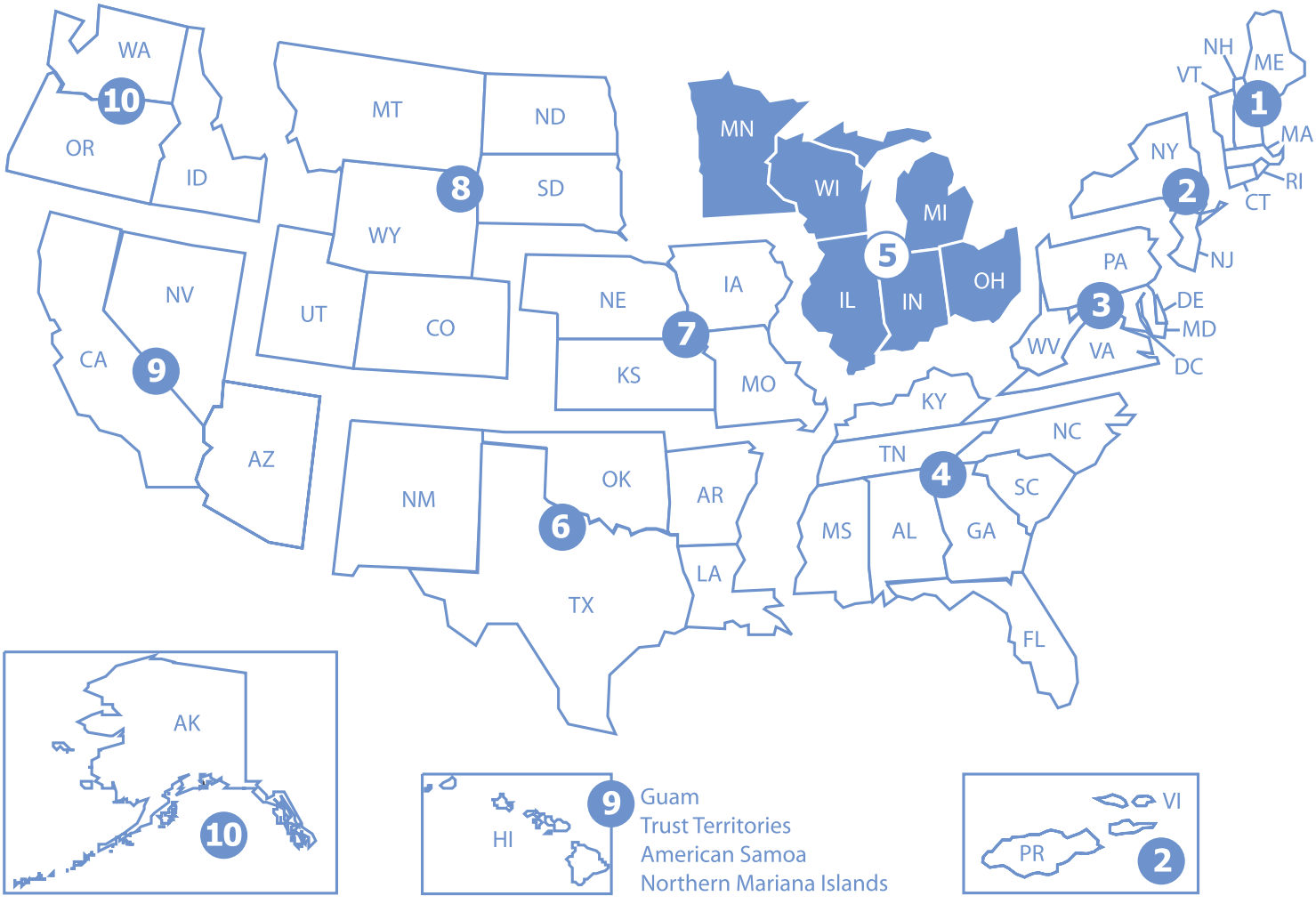
Office of Solid Waste and Emergency Response

Support Document for the Revised National Priorities List Final Rule – East Troy Contaminated Aquifer



Support Document for the Revised National Priorities List Final Rule East Troy Contaminated Aquifer

September 2008

Site Assessment and Remedy Decisions Branch
Office of Superfund Remediation and Technology Innovation
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
Washington, DC 20460

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EXECUTIVE SUMMARY

Section 105(a)(8)(B) of CERCLA, as amended by SARA, requires that the EPA prepare a list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States. An original National Priorities List (NPL) was promulgated on September 8, 1983 (48 FR 40658). CERCLA requires that EPA update the list at least annually.

This document provides responses to public comments received on the East Troy Contaminated Aquifer site located in Troy, Ohio, proposed on September 19, 2007 (72 FR 53509). This site is being added to the NPL based on an evaluation under EPA's Hazard Ranking System (HRS) in a final rule published in the *Federal Register* in September 2008. Several additional sites are being promulgated concurrently.

INTRODUCTION

This document explains the rationale for adding the East Troy Contaminated Aquifer site in Troy, Ohio, to the National Priorities List (NPL) of uncontrolled hazardous waste sites and also provides the responses to public comments received on this site. The EPA proposed this site on September 19, 2007 (72 FR 53509). This site is being added to the NPL based on an evaluation under the Hazard Ranking System (HRS) in a final rule published in the *Federal Register* in September 2008.

Background of the NPL

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. Sections 9601 *et seq*. in response to the dangers of uncontrolled hazardous waste sites. CERCLA was amended on October 17, 1986, by the Superfund Amendments and Reauthorization Act (SARA), Public Law No. 99-499, stat., 1613 *et seq.* To implement CERCLA, EPA promulgated the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, on July 16, 1982 (47 FR 31180), pursuant to CERCLA Section 105 and Executive Order 12316 (46 FR 42237, August 20, 1981). The NCP, further revised by EPA on September 16, 1985 (50 FR 37624) and November 20, 1985 (50 FR 47912), sets forth guidelines and procedures needed to respond under CERCLA to releases and threatened releases of hazardous substances, pollutants, or contaminants. On March 8, 1990 (55 FR 8666), EPA further revised the NCP in response to SARA.

Section 105(a)(8)(A) of CERCLA, as amended by SARA, requires that the NCP include

> criteria for determining priorities among releases or threatened releases throughout the United States for the purpose of taking remedial action and, to the extent practicable, take into account the potential urgency of such action, for the purpose of taking removal action.

Removal action involves cleanup or other actions that are taken in response to emergency conditions or on a short-term or temporary basis (CERCLA Section 101[23]). Remedial action is generally long-term in nature and involves response actions that are consistent with a permanent remedy for a release (CERCLA Section 101[24]). Criteria for placing sites on the NPL, which makes them eligible for remedial actions financed by the Trust Fund established under CERCLA, were included in the HRS. EPA promulgated the HRS as Appendix A of the NCP (47 FR 31219, July 16, 1982). On December 14, 1990 (56 FR 51532), EPA promulgated revisions to the HRS in response to SARA, and established the effective date for the HRS revisions as March 15, 1991.

Section 105(a)(8)(B) of CERCLA, as amended, requires that the statutory criteria provided by the HRS be used to prepare a list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States. The list, which is Appendix B of the NCP, is the NPL.

An original NPL of 406 sites was promulgated on September 8, 1983 (48 FR 40658). At that time, an HRS score of 28.5 was established as the cutoff for listing because it yielded an initial NPL of at least 400 sites, as suggested by CERCLA. The NPL has been expanded several times since then, most recently on March 19, 2008 (73 FR 14719). The Agency also has published a number of proposed rulemakings to add sites to the NPL. The most recent proposal was on March 19, 2008 (73 FR 14742).

Development of the NPL

The primary purpose of the NPL is stated in the legislative history of CERCLA (Report of the Committee on Environment and Public Works, Senate Report No. 96-848, 96th Cong., 2d Sess. 60 [1980]).

> The priority list serves primarily informational purposes, identifying for the States and the public those facilities and sites or other releases which appear to warrant remedial actions. Inclusion of a facility or site on the list does not in itself reflect a judgment of the activities of its owner or operator, it does not require those persons to undertake any action, nor does it assign liability to any person. Subsequent government actions will be necessary in order to do so, and these actions will be attended by all appropriate procedural safeguards.

The NPL, therefore, is primarily an informational and management tool. The identification of a site for the NPL is intended primarily to guide EPA in determining which sites warrant further investigation to assess the nature and extent of the human health and environmental risks associated with the site and to determine what CERCLA-financed remedial action(s), if any, may be appropriate. The NPL also serves to notify the public of sites EPA believes warrant further investigation. Finally, listing a site may, to the extent potentially responsible parties are identifiable at the time of listing, serve as notice to such parties that the Agency may initiate CERCLA-financed remedial action.

CERCLA Section 105(a)(8)(B) directs EPA to list priority sites among the known releases or threatened release of hazardous substances, pollutants, or contaminants, and Section 105(a)(8)(A) directs EPA to consider certain enumerated and other appropriate factors in doing so. Thus, as a matter of policy, EPA has the discretion not to use CERCLA to respond to certain types of releases. Where other authorities exist, placing sites on the NPL for possible remedial action under CERCLA may not be appropriate. Therefore, EPA has chosen not to place certain types of sites on the NPL even though CERCLA does not exclude such action. If, however, the Agency later determines that sites not listed as a matter of policy are not being properly responded to, the Agency may consider placing them on the NPL.

Hazard Ranking System

The HRS is the principle mechanism EPA uses to place uncontrolled waste sites on the NPL. It is a numerically based screening system that uses information from initial, limited investigations -- the preliminary assessment and site inspection -- to assess the relative potential of sites to pose a threat to human health or the environment. HRS scores, however, do not determine the sequence in which EPA funds remedial response actions, because the information collected to develop HRS scores is not sufficient in itself to determine either the extent of contamination or the appropriate response for a particular site. Moreover, the sites with the highest scores do not necessarily come to the Agency's attention first, so that addressing sites strictly on the basis of ranking would in some cases require stopping work at sites where it was already underway. Thus, EPA relies on further, more detailed studies in the remedial investigation/feasibility study that typically follows listing.

The HRS uses a structured value analysis approach to scoring sites. This approach assigns numerical values to factors that relate to or indicate risk, based on conditions at the site. The factors are grouped into three categories. Each category has a maximum value. The categories are:

- likelihood that a site has released or has the potential to release hazardous substances into the environment;
- characteristics of the waste (toxicity and waste quantity); and

- people or sensitive environments (targets) affected by the release.

Under the HRS, four pathways can be scored for one or more threats as identified below:

- Ground Water Migration (S_{gw})
  - drinking water

- Surface Water Migration (S_{sw})
  The following threats are evaluated for two separate migration components, overland/flood migration and ground water to surface water.
  - drinking water
  - human food chain
  - sensitive environments

- Soil Exposure (S_s)
  - resident population
  - nearby population
  - sensitive environments

- Air Migration (S_a)
  - population
  - sensitive environments

After scores are calculated for one or more pathways according to prescribed guidelines, they are combined using the following root-mean-square equation to determine the overall site score (S), which ranges from 0 to 100**:**

$$S = \sqrt{\frac{S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2}{4}}$$

If all pathway scores are low, the HRS score is low. However, the HRS score can be relatively high even if only one pathway score is high. This is an important requirement for HRS scoring because some extremely dangerous sites pose threats through only one pathway. For example, buried leaking drums of hazardous substances can contaminate drinking water wells, but -- if the drums are buried deep enough and the substances not very volatile -- not surface water or air.

Other Mechanisms for Listing

There are two mechanisms other than the HRS by which sites can be placed on the NPL. The first of these mechanisms, authorized by the NCP at 40 CFR 300.425(c)(2), allows each State and Territory to designate one site as its highest priority regardless of score. The last mechanism, authorized by the NCP at 40 CFR 300.425(c)(3), allows listing a site if it meets the following three requirements:

- Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service has issued a health advisory that recommends dissociation of individuals from the release;
- EPA determines the site poses a significant threat to public health; and
- EPA anticipates it will be more cost-effective to use its remedial authority than to use its emergency removal authority to respond to the site.

Organization of this Document

The following section addresses site-specific public comments. The site discussion begins with a list of commenters, followed by a site description, a summary of comments, and Agency responses. A concluding statement indicates the effect of the comments on the HRS score for the site.

Glossary

The following acronyms and abbreviations are used throughout the text:

Agency	U.S. Environmental Protection Agency
ATSDR	Agency for Toxic Substances and Disease Registry
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. Sections 9601 *et seq*., also known as Superfund
cis-1,2-DCE	cis-1,2-Dichloroethene
DL	Detection Limit
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
HRS	Hazard Ranking System, Appendix A of the NCP
HRS score	Overall site score calculated using the Hazard Ranking System; ranges from 0 to 100
IA	Integrated Assessment
MCL	Maximum Contaminant Limit
MDL	Method Detection Limit
NCP	National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Part 300
NPL	National Priorities List, Appendix B of the NCP
OEPA	Ohio Environmental Protection Agency
PCE	Tetrachloroethene
RI	Remedial Investigation
RL	Reporting Limit
SARA	Superfund Amendments and Reauthorization Act of 1986, Public Law No. 99-499, stat., 1613 *et seq*.

TCE	Trichloroethene
TDL	Target distance limit
UST	Underground Storage Tank

RESPONSE TO COMMENTS

1. List of Commenters/Correspondents

EPA HQ-SFUND-2007-0690-0004	Correspondence from Ted Strickland, Governor of Ohio to Mary A. Gade, Regional Administrator, EPA Region 5, received August 6, 2007.
EPA-HQ-SFUND-2007-0690-0005	Comment submitted by Larry J. Huffman, received October 3, 2007.
EPA-HQ-SFUND-2007-0690-0006	Correspondence from Victoria van Roden, Chief, State, Tribal & Site Identification Branch (currently Site Assessment and Remedy Decisions Branch), Office of Superfund Remediation and Technology Innovation, EPA to Howard L. Sharfstein, Senior Counsel, Kimberly-Clark Corporation, dated November 8, 2007.
EPA-HQ-SFUND-2007-0690-0007	Correspondence from Susan L. Gaynor on behalf of Howard L. Sharfstein, Senior Counsel, Kimberly-Clark Corporation to Terry Jeng, State, Tribal & Site Identification Branch (currently Site Assessment and Remedy Decisions Branch), Office of Superfund Remediation and Technology Innovation, EPA, dated November 7, 2007.
EPA-HQ-SFUND-2007-0690-0008	Comment submitted by Mark J. Livengood, Water Reclamation Support, Montgomery County Sanitary Engineering Department, Ohio, received November 8, 2007.
EPA-HQ-SFUND-2007-0690-0010	Comment submitted by Howard L. Sharfstein, Senior Counsel, Kimberly-Clark Corporation, received December 11, 2007.

2. Site Description

The East Troy Contaminated Aquifer site (East Troy) is located in the eastern portion of City of Troy along the western bank of the Great Miami River. (See Figure 1 of the HRS documentation record as proposed.) The site as described in the HRS documentation record as proposed includes two ground water plumes and an area of contaminated soil.

For HRS scoring purposes, two sources of chlorinated solvents were identified in the documentation record as proposed. One source (Source 1) is an area of chlorinated solvents-contaminated soil on property owned by Spinnaker Coating, Inc., a manufacturer of adhesive coated papers and related products. The second source (Source 2) is a contaminated ground water plume, containing elevated levels of tetrachloroethene[1] (PCE) and several PCE degradation products including trichloroethene (TCE), cis-

[1] Also known as perchloroethylene and tetrachloroethylene.

1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride. This plume, named the PCE-contaminated ground water plume (Source 2) in the HRS documentation record as proposed, is upgradient and beneath the Spinnaker property. This plume is present within the upper of two aquifers that underlie the City of Troy, as described below. The source(s) responsible for this PCE-contaminated ground water plume (Source 2) has not been determined, but several possible sources have been identified.

A second ground water plume composed of TCE was identified in the HRS documentation record as proposed based on ground water samples collected from under the Spinnaker property. This TCE plume has not been identified as a source, because sufficient information exists to document that at least part of the TCE came from the contaminated soils (Source 1) on the Spinnaker property. This second plume commingles with the plume identified as Source 2. While the spatial extent of the commingled plumes has not been identified, sample data included in the HRS documentation record as proposed shows the contamination extends at least to east of the Spinnaker property to near the western boundary of the Great Miami River.

Three observed releases to ground water have been identified at the site: one by direct observation and two by chemical analysis. The observed release by direct observation is based on documentation that the TCE contaminated soil on the Spinnaker property (Source 1) extends below the ground water table. One of the observed releases by chemical analysis is identified based on a significant increase in TCE concentrations attributable, at least in part, to the TCE-contaminated soil on the Spinnaker property (Source 1). The second observed release by chemical analysis is identified based on the significant increase in PCE concentrations in ground water that constitute Source 2, but which cannot be attributed to an identified source.

The target population included in the HRS scoring of the site is the 28,000 people who drink ground water from wells drawing from the aquifer containing the PCE- and TCE-contaminated ground water. The wells are in two City of Troy well fields, located across the Great Miami River (on the eastern bank) from the Spinnaker property: the East Well Field and the West Well Field. Five wells are located in the West Well Field and five wells are located in the East Well Field. Chlorinated solvent contamination (from an unidentified source) has been detected in two of these wells. The HRS score is based on the potential for contamination to migrate from the East Troy site to the City of Troy well fields.

Ground water in the area is in an outwash unit[2] consisting of interbedded sand, gravel, and clay. In the vicinity of the site, there are two distinct water bearing layers, an upper and a lower aquifer separated in places by a clay layer of variable thickness and extent. The upper aquifer is unconfined, while the lower aquifer is semi-confined or confined depending on the exact location. The upper aquifer is typically 10 to 40 feet deep and discharges, at least in part, to the Great Miami River. The lower aquifer is thicker than the upper aquifer and consists of buried bedrock valley sand and gravel deposits. The City of Troy wells draw from the lower aquifer. In the HRS documentation record as proposed, EPA identified that the two aquifers were interconnected based on the available geologic descriptions and the results of a pump test performed to determine the wellhead protection area for the City's East Well Field. Ground water flow in the area is generally toward the river, but the well fields also pull water toward themselves (i.e., away from the river).

Remediation at the Spinnaker property started in April 1995 with the removal of impacted soil from the west end of the facility and installation of remediation systems, and focused on the removal of a toluene plume. The soil excavation extended to the water table. Upon completion of the excavation, a pump-and-treat system was designed and installed to address the ground water contamination on the west side of the

[2] An outwash unit is a geologic formation chiefly composed of material carried by running water from the melting ice of a glacier which was laid down in stratified units.

Spinnaker property. The ground water remediation system began continuous operation in August 1995 and continues to operate.

3. Summary of Comments/Correspondence

Ted Strickland, Governor of Ohio, submitted a comment supporting the listing of this site. In an August 6, 2007 letter to EPA Region 5 Administrator, Governor Strickland expressed his support of listing, stating that site assessments have documented that the site poses a significant threat to public health and the environment.

Larry J. Huffman, a former City of Troy resident, commented on the pressing need to find and eliminate the contamination. Mr. Huffman provided a graphic representation of possible locations from which the plumes may have originated. These included locations of various dry cleaners, auto repair facilities, auto dealers, Hobart Cabinet, an appliance store, and a property where barrels were stored.

Susan L. Gaynor, on behalf of Howard Sharfstein, Senior Counsel for the Kimberly-Clark Corporation, wrote to request an extension of the comment period for the East Troy Contaminated Aquifer site. Victoria van Roden, Chief of EPA's State, Tribal & Site Identification Branch, responded to the request, extending the comment period for 20 days until December 10, 2007.

Mark J. Livengood of the Water Reclamation Support of the Montgomery County Sanitary Engineering Department in Ohio recommended that the site be added to the NPL so that investigations into the unknown source(s) of pollutants affecting the aquifer quality can move forward. Mr. Livengood commented that possible sources of contamination include many former and current underground storage tanks (USTs) or above-ground storage tanks used by former and existing businesses; and that further investigation in and around Hobart Cabinet should be performed, noting that until early 2007 the owner operated an old-style solvent dip tank that could have leaked pollutants. Mr. Livengood also suggested reviewing aquifer movement models developed by Panterra (1994) and Malcolm Pirnie, Inc. (2004), to further understand ground water movement in the vicinity of the site.

Howard Sharfstein, Senior Counsel for the Kimberly-Clark Corporation (Kimberly-Clark), commented that EPA has not considered abundant evidence of other, more likely sources of ground water contamination on both sides of the Great Miami River. In particular, Kimberly-Clark asserted that many far more likely potential sources of PCE in ground water on the southwest side of the Great Miami River, and of cis-1,2-DCE on the northeast side of the river, have not been investigated by the EPA. Kimberly-Clark further alleged that the HRS documentation record as proposed includes technical inaccuracies that EPA used to reach scientific conclusions about the precise source of the contamination without a sound technical basis.

Kimberly-Clark commented that the ground water contamination in the shallow aquifer does not migrate into the deeper aquifer in the Spinnaker property, and that EPA incorrectly characterized the shallow and the deep aquifers present in Troy as one "unconsolidated" aquifer without providing a technical justification for this conclusion. In addition, Kimberly-Clark asserted that the contamination in the shallow aquifer on the Spinnaker property does not migrate in detectable concentrations across or under the Great Miami River to the public supply wells in the Troy East Well Field that are in the deeper aquifer.

Kimberly-Clark commented that contamination of the site is not from separate PCE and TCE contaminant plumes mixing, but instead PCE migrates onto the Spinnaker property from upgradient sources and biodegrades to form TCE, cis-1,2-DCE, and vinyl chloride found in the shallow aquifer at the property, and that PCE is not present farther downgradient on the property, closer to the Great Miami River.

Kimberly-Clark commented that at the point where PCE disappears in ground water, it is replaced by TCE, cis-1,2-DCE, and vinyl chloride and other known PCE degradation products.

Kimberly-Clark's specific comments are addressed throughout this support document. EPA also examined the supporting documentation provided as attachments to the comments document by Kimberly-Clark. Specifically, Kimberly-Clark submitted the following attachments to its comments document:

- Attachment A – Analytical data tables summarizing the history of ground water VOC analyses from 1993 through September 2007 (Kimberly-Clark, 2007)

- Attachment B – Closure Report, Spinnaker Facility -- West End, Troy, Ohio (Mill Creek Environmental Services, 2002)

- Attachment C – Figure from EPA guidance showing pathways associated with reductive dehalogenation of chlorinated ethenes, such as PCE, TCE, cis-1,2-DCE, and vinyl chloride (EPA 1998, Figure 2 .2, p. 24)

- Attachment D – A potentiometric map of the east and west ends of the Spinnaker facility (Mill Creek Environmental Services, November 2007)

- Attachment E – Response to Ohio EPA Review Comments, Spinnaker Closure Report, Troy, Ohio (Kimberly-Clark, April 2003)

- Attachment F – A map showing the locations of potential sources based on a review of the history of property uses in Troy on both sides of the Great Miami River that have not been considered in the HRS Documentation Report (Kimberly-Clark, 2007)

- Attachment G – A graph showing PCE concentrations over time in ground water samples collected from EEIB-4, a monitoring well located on the upgradient property boundary of the Spinnaker property from December 2000 through September 2007 (Kimberly-Clark, 2007)

These attachments were reviewed by EPA to identify if any specific comments on the HRS evaluation not already presented in Kimberly-Clark's main comment document were raised, or if contradictory information that would demonstrate that the HRS scoring was inaccurate was presented. Neither new comments nor contradictory information were identified in EPA's review.

3.1 Requests for Extension

Susan Gaynor, Roswell Administrative Staff Team Leader and Senior Paralegal II to the Kimberly-Clark Corporation, requested a 30-day extension of the public comment period for the East Troy Contaminated Aquifer site on November 7, 2007, on behalf of Howard Sharfstein, Senior Counsel for the Kimberly-Clark Corporation. Ms. Gaynor's correspondence included a letter to EPA dated October 23, 2007, from Mr. Sharfstein, requesting a 30-day extension of the public comment period for the East Troy Contaminated Aquifer site on behalf of the Kimberly-Clark Corporation. Kimberly-Clark stated that it required an extension due to EPA's delay in providing all reference documents used to support the HRS scoring of the site, and the need for additional time due to the complex hydrogeological and technical issues underpinning the basis for the proposed listing.

In response, on November 8, 2007, Victoria van Roden, Chief, EPA State, Tribal, and Site Identification Branch, granted a 20-day extension to the public comment period for the East Troy Contaminated Aquifer

site, thereby extending the comment period for the site to December 10, 2007. EPA granted the extension due to a 20-day delay in the Kimberly-Clark Corporation receiving all requested materials. EPA provided the Kimberly-Clark Corporation with an electronic copy of all reference documents cited in the HRS documentation record as proposed within 2 business days, with the exception of related oversized maps. Due to difficulty in reproducing the maps, EPA was unable to provide the oversized maps to the Kimberly-Clark Corporation until 20 days after the request.

3.2 Support for Listing

Several commenters expressed support for listing the site. Larry J. Huffman noted that there was a pressing need to find and eliminate the contamination sources for the East Troy Contaminated Aquifer, especially since it is not known how long the plumes have been in operation and there could be long-term effects of the contamination. Mark J. Livengood also recommended that the site be added to the NPL so that investigations into the unknown source(s) of pollutants affecting the aquifer quality can move forward. Governor Strickland expressed his support of listing, stating that site assessments have documented that the site poses a significant threat to public health and the environment.

In response, EPA is adding the East Troy Contaminated Aquifer site to the NPL. Listing makes a site eligible for remedial action funding under CERCLA. EPA will examine the site to determine the appropriate response action(s), which will include identifying the sources of the ground water contamination. EPA will determine the need for using Superfund monies for remedial activities on a site-by-site basis, taking into account the NPL ranking, State priorities, further site investigation, other response alternatives, and other factors as appropriate. Actual funding of site remediation may not necessarily be undertaken in the precise order of HRS scores and, upon more detailed investigation, may not be necessary at all in some cases.

3.3 Identification of Contamination Sources

Larry J. Huffman and Kimberly-Clark questioned whether it was appropriate for EPA to identify only two sources of contamination in the HRS evaluation of the site, and specifically identified what they considered possible sources of the PCE ground water plume (Source 2). Mr. Huffman and Kimberly-Clark noted that there are numerous possible sources of contamination in the City of East Troy on both sides of the Great Miami River. Facilities mentioned by these two commenters include:

- Multiple former dry cleaners located on both the southwest and northeast sides of the river,
- Auto repair facilities located on both the southwest and northeast sides of the river,
- Auto dealers located on the southwest side of the river,
- Hobart Cabinet located upgradient of the Spinnaker property on the southwest side of the river,
- A former industrial property located upgradient of the Spinnaker property,
- An appliance store and three printing facilities located southwest (upgradient) of the Spinnaker property,
- Maintenance operations at the Troy water treatment plant on the northeast side of the river, and
- The former City of Troy electrical generating plant located immediately upgradient of two of the city's production wells on the northeast side of the river.

Kimberly-Clark stated that the former City of Troy electrical generating plant, maintenance operations at the Troy water treatment plant, and dry cleaner and auto repair facilities near and along Staunton Road on the northeast side of the Great Miami River are all more likely sources of the VOCs impacting wells in the Troy East Well Field than is any potential source on the southwest side of the Great Miami River.

Kimberly-Clark commented that EPA should acknowledge in the rulemaking record that historical information indicates there are other potential sources of the East Well Field contamination that have yet to be investigated. Kimberly-Clark went on to say that many far more likely potential sources of the PCE in ground water on the southwest side of the Great Miami River, and of cis-1,2-DCE in ground water on the northeast side of the river, have been identified but have apparently not been investigated by EPA.

In response, sufficient information was gathered and presented in the HRS documentation record as proposed to support listing of the East Troy Contaminated Aquifer site and, specifically, the identification of a contaminated soil source and a ground water plume source. The level of collected information is consistent with the primary purpose of the NPL—to identify for the States and the public those sites that appear to warrant remedial action (56 FR 35842, July 29, 1991). Listing this site as commingled ground water contamination originating from the contaminated soil and a ground water plume with no known sources acknowledges that not all of the original sources contributing to the contaminated plume at this site are known. Each of the two sources evaluated, the contaminated soil on the Spinnaker property (Source 1) and the contaminated ground water plume (Source 2), meet the HRS definition of a source. HRS Section 1.1. *Definitions*, defines a source as:

> Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. . . . [I]n the case of either a ground water plume with no identified source or contaminated surface water sediments with no identified source, the plume or contaminated sediments may be considered a source.

As is discussed below, the site and source descriptions in the HRS documentation record as proposed and the site investigations performed prior to the proposed listing of the East Troy Contaminated Aquifer site cited in the HRS documentation record contain sufficient information to meet the HRS requirements for identifying that there are two sources at the site.

In 2000, EPA and the Ohio EPA (OEPA) performed an Integrated Assessment (IA) of the contamination in the vicinity of the Spinnaker property. The Integrated Assessment Report (Reference 8 to the HRS documentation record as proposed) describes the investigations and extent of the PCE-contaminated plume. OEPA advanced six soil borings and collected 18 ground water samples directly from the boreholes. OEPA also installed two monitoring wells and collected 25 ground water samples from monitoring wells, as well as treatment wells and municipal production wells, to look for contaminant source areas and to delineate the pathway by which VOCs entered the East Troy Well Field (see page 27 of the HRS documentation record as proposed). This sampling identified that while there was ground water contamination under the Spinnaker property, based on contamination in well samples from the upgradient (south west) side of the Spinnaker property, there was also most likely an upgradient source of contamination (page 17 of Reference 8).

As a follow-up to the 2000 IA, EPA and the State of Ohio performed an Expanded Site Inspection (ESI) (Reference 9 to the HRS documentation record as proposed) in 2002, and a Supplemental Expanded Site Inspection (Reference 13 of the HRS documentation record as proposed) from 2002 to 2006 in an attempt to document an identified source for the PCE ground water plume. The intent of the site investigation performed for this site was to obtain sufficient information to obtain an HRS score, and specifically, to

determine if a source(s) could be identified for the PCE ground water plume. The investigation carried out for the site included a site reconnaissance, record searches, and sampling to gain information on possible origins of the ground water contamination.

As part of the ESI for the site (see Reference 9 of the HRS documentation record as proposed), OEPA advanced 20 borings and collected ground water samples from 19 of these borings. Most of these borings were from upgradient of the Spinnaker property. The samples were analyzed for VOCs, including PCE, TCE, cis-1,2-DCE, and vinyl chloride. In addition, four monitoring wells were also installed at the site, three of which were upgradient of the Spinnaker property. The ground water samples from these monitoring wells were also analyzed for VOCs (see pages 10 and 11 of the HRS documentation record as proposed). This effort confirmed earlier suspicions that there clearly was a separate plume of PCE and related chlorinated solvents upgradient of and possibly sidegradient to the Spinnaker property. Based on the variation in the PCE levels it appeared that there was likely to be more than one source of the plume. Furthermore, given that several non-detect levels of PCE were found 4 blocks upgradient of the Spinnaker property, it was likely that the plume source(s) were within 4 blocks of the Spinnaker property. However, the highest concentrations were found in front of a multi-family dwelling, not clearly associated with a known source. Sampling near a former dry cleaner and a former railroad bed on a cabinet facility showed contamination, but at lower concentrations, suggesting they were not the only sources (see Figures 2 and 3 of Reference 9 of the HRS documentation record as proposed).

As discussed in a Supplemental ESI Report dated 2007 (Reference 13 of the HRS documentation record as proposed), between 2002 and 2007, OEPA installed 13 additional monitoring wells, advanced 34 soil borings, and sampled multiple times, analyzing the samples for VOCs. The results of these sampling events confirmed the conclusions from the ESI, that no individual source of the PCE plume upgradient of the Spinnaker property was identified.

The definition of source in the HRS provides that contaminated ground water plume should be identified as a source only if there is no "identified source." Generally, EPA interprets the term "identified source" to be a source to which a release can be at least partially attributed. This interpretation follows from the HRS requirement that observed releases be at least partially attributable to a site when sources at a site are identified. If an observed release can be attributed to a source, the source should be considered an "identified source." On the other hand, if observed releases cannot be attributed to any particular source, it is reasonable to conclude that there is no "identified source."

The HRS requires that the hazardous substances in observed releases by chemical analysis not only be significantly above background level in concentration, but also be in part attributable to the site when the site includes identified sources (see HRS Section 2.3, *Likelihood of release*: "some portion of the release must be attributable to the site"). This attribution can generally be demonstrated in two steps. The first step involves showing that the released substances can be associated with the site by documenting their presence in a source or by other documentation regarding site operations, which indicate the substances were deposited or are present in a source with an HRS containment value greater than zero (see HRS Section 2.2.2, *Identify hazardous substances associated with a source*). When there are multiple possible sources in the vicinity of the site that may be contributing to the significant increase, the second step consists of documenting that some part of the increase is from the on-site source(s).

Generally, EPA considers that it is necessary to obtain sufficient samples between the site being evaluated and other known potential sources (or between the site and adjacent sites) to demonstrate an increase in concentration attributable to the site. Additional information may be appropriate if other sites are known to release substances intermittently, such that "pulses" of hazardous substances are created in environmental media.

Information to demonstrate attribution may include:

- concentration gradients (e.g., established based on samples from a series of samples between the site and the alternative source),

- flow gradients or other information about the movement of the hazardous substances in the environmental medium of concern, or

- analytical fingerprinting data that establish an association between the site and a unique form of a substance or unique ratios of different substances.

The HRS documentation record as proposed demonstrates that EPA's decision to treat the PCE ground water plume contamination as the source is consistent with the HRS and with EPA's interpretation of the term "identified source" in the HRS. EPA examined the area of the site and investigated several possible sources as described in its site investigation and site assessment activities. EPA agrees with the commenters that there are numerous possible sources on both the east and west sides of the Great Miami River. In fact, EPA identified so many possible sources of the PCE contamination that it determined it would be impracticable to establish partial attribution to any particular source within the scope of the site assessment. First of all, it is impracticable to establish background levels between all the possible sources, both because of the number of sources, including known and unknown sources and those no longer present, and because of the sources' proximity to each other. For example, the possible sources associated with industrial and commercial operations in the City of Troy adjacent to the Great Miami River are also adjacent to and in some cases contiguous with each other, as shown on the map submitted by Mr. Huffman with his comments.

Also, establishing concentration gradients requires sufficient samples with consistent gradations in concentrations between possible sources. The lack of any significant distance between sources and the large number of all the possible sources makes establishing concentration gradients impractical in this situation. To establish statistically significant concentration gradients would require sufficient sampling locations, sufficient change in concentration between locations, and sufficient number of samples to sort out the variation in contaminant concentrations due to natural randomness, sampling variation, seasonal variation, and other uncontrollable factors from the variation due to contaminant releases and subsequent migration. Mr. Huffman's submitted information shows multiple possible sources directly adjacent to each other, as well as different possible activities in the same location over time.

It is also not practicable to fingerprint and trace a pattern of contamination to any single source, given the number and proximity of the sources. Most of these possible sources are associated with solvents; the type and blend of solvents used over time is simply not known, and may never have been known even to the facility operators, since many products are sold as generic blends with little if any quality control. Developing statistically significant fingerprints for all the possible sources in this developed industrial/commercial area would require a very high number of samples and would necessitate a long period of study and analysis to establish. To do so would require determining what contaminants were released and how the ratios of contaminants used at the facilities varied from one day to the next over a long period of time (at least the last half century given that some of the sources are dated to the 1940s according to Mr. Huffman's submitted information) from all the possible sources (which, as identified by the commenters, would number at least 14 in a 20-block area) and then determining the ratios of the contaminants in each of those releases. Further, the large possible number of overlapping fingerprints makes the probability of this activity being successful extremely remote, even if it were possible to obtain

this level of information on each possible source.[3] It is likely that many sources may be releasing the same substances, thereby, confounding any chemical ratios.

For similar reasons, it is also impracticable to even establish location specific ground water flow gradients between the possible sources over the time period involved. When sources are packed closely together, activities over time such as paving a parking lot or building a new structure between two possible sources can change the local ground water flow direction at this level of detail and thus change the local flow gradients.

Commenters did not point to any set of data that would provide evidence for partially attributing any specific areas of contamination at the site to particular sources. They speculated that it should have been able to be done, but did not actually provide any documentation doing so. They also did not present or suggest any sampling plan that would achieve attribution of the PCE contamination in the ground water plume to specific sources.

Further, as Kimberly-Clark conceded in its comments, "the principal purpose of an NPL listing is to determine whether sufficient information exists to identify a site as one warranting further investigation as a NPL site and not necessarily to identify specific sources or potentially responsible parties associated with the contamination at issue." Listing the East Troy Contaminated Aquifer site meets this objective, and the sources evaluated as part of this site meet the HRS definition of a source.

Regarding the possible sources of chlorinated solvents east of the Great Miami River, these sources are not considered part of this site at this time. There is insufficient information to show that any releases from them are contiguous with or commingled with the releases identified as part of this site.

Finally, it should be noted that, even if EPA were able to identify additional sources of contamination in the vicinity of this site and the City of Troy Well fields, it would not change the site score. An HRS score is generally based on the substances associated with site sources, the waste quantity of sources, the identification of releases from the site, and the targets within a set distance from the sources. Identifying specific sources of the PCE ground water contamination plume in the HRS scoring would require replacing the PCE ground water plume as a scored source (Source 2) with one or more of the possible sources of this plume. However, because PCE would be associated with these new sources, PCE would still be considered associated with the East Troy Contaminated Aquifer site. In addition, because the plume was associated with a minimal waste quantity (>0), adding additional sources would, if anything, likely increase the waste quantity associated with the site. Also the observed release documented based on the presence of the PCE plume would be revised to be attributable to any new sources, so again, an identification of an observed release of PCE would not be lost. In addition, since the targets scored are all within the required target distance limit (TDL) of Source 1, which would still be included as part of the site, addition of other sources could only increase the number of eligible targets. Thus, including additional sources to the site would result either in no change to the HRS site score or increase it.

The other source included in the site scoring was Source 1, contaminated soil (see pages 17–26 of the HRS documentation record as proposed). Kimberly-Clark did not contest the identification of this source. It is located on the Spinnaker property next to (or in) the Bulk Storage Area and Non-hazardous Waste Storage Areas. Based on soil sampling in 2005 by Shaw for Kimberly-Clark (Reference 7 of the HRS documentation record as proposed), after a 1995 removal action by Kimberly-Clark, several contaminants remained in soils at the Spinnaker facility, including TCE, PCE and cis-1,2-DCE (pages 18–24 of the HRS documentation record as proposed). In addition, no containment structures are in place to contain the migration of the contaminants. Thus, the contaminated soil is clearly soil that came to be

[3] The impracticability of this approach is further highlighted given the HRS's role as a screening tool.

contaminated due to migration and meets the HRS definition for a source stated earlier in this section of this support document. In addition, because the contaminated soil extends below the ground water table, its presence also supports an observed release by direct observation to ground water (see section 3.9.1, *Observed Release by Direct Observation,* of this support document.)

3.4 Possible Remedial Actions

Mark J. Livengood commented that future remedial actions could include identification of any remaining USTs in the area by use of ground penetrating radar to study the subsurface for voids, etc. Investigation in and around Hobart Cabinet might be warranted, particularly because, until early 2007, the owner allegedly operated an old-style solvent dip tank that could have leaked pollutants. The investigation might also study the subsurface of the basement floor at the current location of the City of Troy police station as well as review of city files for photos and notes taken during construction looking for evidence of old USTs that may have been present during soil removal. Mr. Livengood further commented that aquifer movement models developed by Panterra (1994) and Malcolm Pirnie, Inc. (2004), should be reviewed to further understand ground water movement. Mr. Livengood stated that the possible negative effects on well field water quality when the city opens the low level dam gates (now open) should be considered, noting that past models have shown the elevation of the Great Miami River pool affects how pollutants may flow from south to north when the East Well Field wells are pumping.

In response, EPA acknowledges Mr. Livengood's concerns for the need for response to all releases from all possible sources to the site. The need for such response actions and the appropriateness and extent of the response actions will be considered when EPA evaluates the need for remedial actions to protect human health and the environment.

In general, under the Superfund program, EPA investigates sites in two stages:

- Site assessment: a screening-level evaluation of all sites to determine those for which response action may be required, culminating in the listing of sites on the NPL, where appropriate; and

- Response action: a comprehensive evaluation of NPL sites to determine the nature and extent of contamination, and to select and implement any necessary site cleanup actions.

Consideration of separate response actions is not a factor in the decision to list the site on the NPL. Listing of a site informs the public that EPA has determined the site poses sufficient threat to human health and the environment to warrant further investigation. The appropriate actions necessary to mitigate those threats, including the types of actions suggested by Mr. Livengood, are typically undertaken after the listing process is completed.

3.5 Actual Risk

Kimberly-Clark raised issues that questioned whether or not releases from the Spinnaker property could pose a risk to the drinking water supply, specifically the Troy Well Fields. Kimberly-Clark asserted that, using even the most conservative ground water modeling assumptions, the concentrations of VOCs at the Spinnaker site do not present a risk to the East Troy Well Field. Kimberly-Clark commented that "regardless of the source of PCE and other constituents in the shallow ground water on the Spinnaker property, these constituents have not, do not, and will not cross the Great Miami River or impact the deeper aquifer that is used for Troy's production Wells."

Kimberly-Clark also commented that sampling/test data show that contamination present in the shallow aquifer did not migrate to the deeper aquifer even in the Spinnaker property, and it poses no threat to the City of Troy's East Well Field production wells. Kimberly-Clark stated that:

- Test borings completed at times between 1993 and 2005 show that concentrations of chemicals decrease rapidly with depth below the water table,

- The concentrations at the deepest borings (approximately 40 feet below land surface) were near laboratory MDLs, and these were likely artifacts of field procedures rather than actual ground water contamination,

- Monitoring well RS06 screened in the shallow aquifer (30–40 feet below land surface) and located downgradient of the Spinnaker property (Source 1) near the Great Miami River did not show contamination for PCE or its degradation products when tested 28 times since its installation in 2000, and

- Two production wells located on the north side of the Spinnaker property in the "source area" assumed to be screened in the deeper aquifer (because of relatively high yields) sampled twice in 1994 and 1997, and once in 1999 and 2000 showed no contamination above the MDLs.

In response, the contaminated ground water associated with the East Troy Contaminated Aquifer site, including releases from the Spinnaker facility, presents sufficient relative risk to warrant listing and is a potential threat to the users of City of Troy's production wells. To place the site on the NPL, the HRS does not require documentation of actual harm caused by the releases at a site or that environmental benchmarks be exceeded. The HRS is not a risk assessment; rather, it is a screening tool for identifying sites that pose sufficient actual or potential risk to warrant further investigation. In the preamble to the HRS, EPA stated:

> The Agency stresses that the limited data generated at the SI stage are designed to support site screening, and are not intended to provide support for a quantitative risk assessment (55 FR 51541, December 14, 1990).

EPA will consider the results of the risk assessment when it evaluates remedial options at the site during a separate stage of the Superfund process. At that time, EPA will consider the information provided by Kimberly-Clark regarding actual risk (e.g., the contaminant transport modeling studies and other information contained in Appendix B of the Kimberly-Clark comments).

Regarding Kimberly-Clark's statement that if that the worst-case scenario were to be accepted, then the concentration of contamination at the city wells would be below detection, as discussed above, the HRS evaluation for these wells is not contingent in any way on contamination being present in the city wells attributable to the site (see sections 3.10, *Targets*, and 3.8, *Aquifer Interconnections*, of this support document).

Furthermore, the Agency does not agree that the site poses no actual or potential risk. Releases from this site have not been adequately contained or remedied. As documented in the HRS documentation record as proposed, observed releases by direct observation and by chemical analysis attributable to the site have been documented (see pages 37–46 of the HRS documentation record as proposed). TCE concentrations as high as 5.92 µg/L have been documented in ground water below the Spinnaker property. PCE concentrations as high as 53 µg/L (10 times the Federal drinking water standard [MCL]), TCE

concentrations as high as 34 µg/L (more than 6 times the Federal drinking water standard [MCL]), cis-1,2-DCE concentrations as high as 69.1 µg/L (compared to the Federal drinking water standard of 70 µg/L [MCL]), and vinyl chloride concentrations as high as 6.6 µg/L (over 3 times the Federal drinking water standard [MCL]) have been detected in the contaminated plume with no identified source associated with this site (Source 2).

These contaminants are in an aquifer system utilized for drinking water by the City of Troy where already two of the municipal wells have cis-1,2-DCE present (see pages 40–46 and 50 of the HRS documentation record as proposed). As discussed in more detail in other parts of this response, to be considered in HRS scoring it is not necessary that contamination from the site is actually migrating through the aquifer and reaching the well fields considered in the site scoring, only that (1) the aquifer is continuous to the well fields and is interconnected within 2 miles of the sources at the site, (2) no discontinuity in the aquifer exists that entirely transects the aquifer between the well fields and the site sources, and (3) the wells are within the required target distance limit from the site sources. Sections 3.8, *Aquifer Delineation,* and 3.10, *Targets,* of this support document discuss the aquifer being evaluated and the evaluation of targets associated with this site, and how the scoring at the site met the HRS requirements. This section addresses all comments that could be interpreted as questioning these findings.

3.6 Site Conditions

Kimberly-Clark questioned the technical accuracy of several of the conclusions in the rulemaking record for the site, and specifically those describing the impact of contamination associated with the Spinnaker operations based on contamination in wells at the City of Troy East Well Field. Kimberly-Clark stated that it recognizes that the principal purpose of an NPL listing is to determine whether sufficient information exists to identify a site as warranting further investigation as an NPL site and not necessarily to identify specific sources or potentially responsible parties associated with the contamination at issue. "Nevertheless," commented Kimberly-Clark, "it would be highly inappropriate for USEPA to create a rulemaking record available to the public that includes technical inaccuracies and that reaches scientific conclusions about the precise source of contamination without a sound technical basis."

Kimberly-Clark requested that EPA respond to Kimberly-Clark's comments by "either (i) advancing the additional technical justification necessary to refute K-C [Kimberly-Clark]'s well-supported contention that the Spinnaker property is not a source of contamination at the Troy East Well Field, or (ii) at a minimum, acknowledging that inadequate information currently exists to conclude that the Spinnaker property is a source of that contamination."

Kimberly-Clark also requested that EPA acknowledge in the rulemaking that historical information indicates that there are other potential sources of the East Well Field contamination that have not been investigated. (See also Section 3.3, *Identification of Contamination Sources,* of this support document for Kimberly-Clark's detailed comments on this subject and EPA's responses to its comments.)

In response, the information contained in the HRS documentation package and used to perform the HRS scoring of the site is sufficient for placing this site on the NPL, as is shown in later sections of this support document, which address all HRS scoring issues raised by commenters. These sections also address all statements Kimberly-Clark considers to be technical inaccuracies.

Kimberly-Clark is asking for EPA to produce information not necessary to support the listing decision. EPA is not required, prior to the site listing, to thoroughly investigate all possible sources at a site, or to determine the exact extent of the contamination associated with the site. The HRS is a screening tool to determine whether a site should be placed on the NPL for possible Superfund response. A subsequent stage of the Superfund process, the remedial investigation (RI), will characterize conditions and hazards

at the site more comprehensively. EPA notes that any additional data characterizing site conditions could provide useful information during the RI.

At this site, EPA evaluated two sources, TCE-contaminated soil on the Spinnaker property (Source 1) and a PCE-contaminated ground water plume with no identified source(s) (Source 2). An observed release to ground water by direct observation and two observed releases by chemical analysis were documented in the HRS documentation record as proposed. The observed release by direct observation was identified because the contaminated soil source on the Spinnaker property is in direct contact with the water table. TCE and other chlorinated solvents have been documented in soil samples collected below the ground water table on the Spinnaker property. One observed release by chemical analysis was based on the finding of TCE in ground water samples collected on the Spinnaker property (see page 37 of the HRS documentation record as proposed). Another observed release of PCE and its breakdown products has been detected in ground water samples collected upgradient of and under the Spinnaker property. This PCE-contaminated ground water plume is identified as Source 2, a contaminated ground water plume with no identified source(s).

In addition, the components of the site as described and documented at listing are not necessarily the final extent of the site. As discussed in Section F of the Preamble to the proposed rule to add the East Troy Contaminated Aquifer site to the NPL (72 FR 53509–53519, September 19, 2007):

> The NPL does not describe releases in precise geographical terms; it would be neither feasible nor consistent with the limited purpose of the NPL (to identify releases that are priorities for further evaluation), for it to do so. Indeed, the precise nature and extent of the site are typically not known at the time of listing.
> When a site is listed, the approach generally used to describe the relevant release(s) is to delineate a geographical area (usually the area within an installation or plant boundaries) and identify the site by reference to that area. However, the NPL site is not necessarily coextensive with the boundaries of the installation or plant, and the boundaries of the installation or plant are not necessarily the "boundaries" of the site. Rather, the site consists of all contaminated areas within the area used to identify the site, as well as any other location where that contamination has come to be located, or from where that contamination came.

The site description and evaluation of sources and releases in the HRS documentation record as proposed are sufficient to identify for the public the nature of the contamination and the potential threat posed by the site to the targets evaluated. While the HRS documentation record did not identify any drinking water wells that are actually contaminated due to a release from the site, the potential threat posed to the Troy East and West Well Fields is evident in that a release of hazardous substances was documented in the combined aquifer from which these municipal wells withdraw drinking water. The evaluation of this potential threat is consistent with the HRS. These issues are discussed further in sections 3.9, *Likelihood of Release*, and 3.10, *Targets*, of this support document.

Finally, with respect to Kimberly-Clark's comments that it recognizes that the principal purpose of an NPL listing is to determine whether sufficient information exists to identify a site as one warranting further investigation, the HRS listing of the East Troy Contaminated Aquifer site serves this purpose.

3.7 Conceptual Site Model

Kimberly-Clark commented that the sources of the VOC contamination and the transport route by which the contamination could migrate to drinking water wells was incorrectly conceptualized and evaluated in the HRS scoring of the site. It asserted the site consisted of only one plume and that the contamination

could not migrate to the City of Troy East Well Field. These comments are addressed in the following sections:

- Section 3.7.1, *Two Plumes or One Migrating Plume/Extent of Site*
- Section 3.7.2, *Contamination in City of Troy's Production Wells*

3.7.1 Two Plumes or One Migrating Plume/Extent of Site

Kimberly-Clark stated that "[t]here is no evidence of 'commingled' PCE and TCE plumes with separate sources," but instead PCE migrates onto the Spinnaker property from upgradient sources and biodegrades to form TCE, cis-1, 2-DCE, and vinyl chloride found in the shallow aquifer at the property, until it is no longer present farther downgradient on the property closer to the Great Miami River. Kimberly-Clark asserted that this can be seen from analytical data. Kimberly-Clark stated that this assertion is further supported by the close correlation of TCE concentrations with the variations in concentration of PCE at the site. Kimberly-Clark further stated that ground water geochemistry in the shallow aquifer changes from conditions that do not support biodegradation of PCE to conditions that do support biodegradation under the Spinnaker property, citing Attachment B to its comments.

In response, as discussed below, the information and rationale contained in the HRS documentation record as proposed is sufficient for considering the contamination at the site to be from two separate HRS sources, and that the releases from the sources have commingled in the ground water.

The information used to identify that there are two comingling contamination plumes includes: (1) a TCE contaminated soil source on the Spinnaker property (Source 1), (2) observed releases by direct observation and by chemical analysis of TCE at least in part from the Spinnaker property to ground water; and (3) an observed release of PCE (and several of its degradation products (i.e., TCE, cis-1,2-DCE, and vinyl chloride) by chemical analysis from several other, unidentified sources (Source 2). As discussed below, the identification of the two sources and the observed releases is consistent with HRS requirements.

Separate Sources
The identification of a soil source (Source 1) and a ground water plume source (Source 2) is consistent with the HRS definition of a source. The HRS defines the term "source" in Section 1.1, *Definitions*. It states in part that a source includes "soils that have become contaminated from migration of a hazardous substance." It also states that a contaminated ground water plume can be evaluated as a source for HRS scoring when the plume has no identified source(s) of contamination. Based on these requirements, the soil source (Source 1) and the ground water plume source (Source 2) have been correctly identified in the HRS documentation record as proposed. (See section 3.3, *Identification of Contamination Sources*, of this support document).

Commingling of Releases from Source 1 and Source 2
HRS Section 3.1.1, *Observed release*, identifies the requirements for establishing an observed release to ground water. It states that an observed release to an aquifer can be established by "demonstrating that the site has released a hazardous substance to the aquifer" through two means:

- Direct observation—a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer.
- Chemical analysis—an analysis of ground water samples from the aquifer indicates that the concentration of hazardous substance(s) has increased significantly above the

> background concentration for the site. . . . Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the source itself consists of a ground water plume with no identified source, no separate attribution is required.

Pages 37–43 of the HRS documentation record as proposed contain discussions of several observed releases of VOCs to ground water. Pages 37–38 of the HRS documentation record as proposed document an identification of an observed release of TCE by direct observation for the contaminated soils at the Spinnaker Property (Source 1). TCE was identified in soil on the Spinnaker property below the ground water table, therefore establishing direct observation of TCE being in direct contact with the aquifer below the property. An observed release by chemical analysis of TCE (at least in part attributable to the contaminated soil on the Spinnaker property) is also identified on pages 38–40 and 44 of the HRS documentation record as proposed, from Source 1. Furthermore, as explained on pages 40–43 of the HRS documentation record as proposed, another observed release of PCE to the aquifer based on the presence of the PCE contaminated ground water plume (Source 2) was established by chemical analysis. This was done by showing that the concentration of PCE and several of its degradation products in this plume were significantly above their background concentrations for the site. As provided in HRS Section 3.1.1, *Observed release*, no separate attribution is required for this release, because it is also identified as a ground water plume with no identified source(s) (Source 2).

Therefore, the HRS documentation record as proposed demonstrates an observed release from Source 1 by (1) direct observation based on the TCE-contaminated soil on the Spinnaker property and (2) by chemical analysis based on a significant increase of TCE in ground water samples from under the Spinnaker property. EPA has also established an observed release to the ground water by chemical analysis as evidenced by the presence of PCE in the ground water plume. As Kimberly-Clark recognizes on page 2 of its comment letter and as discussed on page 16 of the HRS documentation record as proposed, the PCE-contaminated ground water plume (Source 2) flows from upgradient of the Spinnaker property under the property and toward the river located downgradient of the property. Because EPA has established an observed release of TCE to the ground water from Source 1, it follows that at least some of the TCE present in the ground water results from this source. In other words, the release from Source 1 is co-located, and thus comingles with, the PCE-contaminated ground water plume (Source 2).

Therefore, EPA has identified two HRS eligible sources of chlorinated solvents, and has documented observed releases from each source and demonstrated that the plumes associated with these sources and releases are distinct but overlap and are thus commingled.

3.7.2 Contamination in East Well Field

Kimberly-Clark raised issues with the inclusion of the City of Troy's East Well Field in the HRS scoring of the site because the contamination in the well field was not consistently found. Kimberly-Clark asserted that cis-1,2-DCE is the only VOC detected in Troy's East Well Field with any consistency (i.e., not in every sample but in at least half of the samples from two of the five wells in the East Well Field), and that TCE has also been detected at very low concentrations on rare occasions. Furthermore, the OEPA, at the request of EPA, twice earlier in 2007, collected samples that show cis-1,2-DCE present in samples from two production wells in Troy's East Well Field, while TCE was not detected. VOCs have not been detected in samples collected from any of the other three production wells in the Troy East Well Field.

In response, as discussed below, the HRS evaluation of the City of Troy's production wells does not reflect any consideration of the cis-1,2-DCE or any other hazardous substance in samples from these wells as being from either of the two sources associated with the East Troy Contaminated Aquifer site.

The Troy wells were considered as potential targets only, meaning that it was not required that any release attributable to the site be found in the samples from the wells according to HRS Section 2.5, *Targets*.

HRS Section 2.5, *Targets*, identifies one type of target as that which is "subject to a potential release (that is, target is not associated with actual contamination for that pathway or threat.)." To score wells as potentially threatened targets, the HRS does not require that hazardous substances be consistently found in these wells, or found at any concentration. HRS Section 2.5, *Targets*, states: "Actual contamination: Target is associated either with a sampling location that meets the criteria for an observed release (or observed contamination) for the pathway or with an observed release based on direct observation for the pathway . . ."

As detailed on pages 49–53 of the HRS documentation record as proposed, the City of Troy obtains its drinking water from two municipal well fields, East Well Field (five wells) and West Well Field (five wells), and these wells are within the target distance limit for the site. As presented in section 3.3.2.4, *Potential Contamination*, on page 50 of the HRS documentation record as proposed, cis-1,2-DCE was detected at estimated levels in two of the municipal wells, but EPA did not establish an observed release and, therefore, actual contamination. Hence, these detections were not used to score the wells in the City's well fields as potentially threatened targets.

Thus, Kimberly-Clark's comments regarding the finding of VOCs in the City of Troy Well fields have no effect on the HRS site score or the site listing decision.

3.8 Aquifer Delineation

Kimberly-Clark questioned the delineation of the aquifer being evaluated in the HRS scoring of the site. Kimberly-Clark commented that ground water contamination in the shallow aquifer does not migrate into the deeper aquifer beneath the Spinnaker property, nor does it migrate across the Great Miami River in the shallow aquifer.

Kimberly-Clark's specific comments regarding aquifer interconnections and discontinuities and associated Agency responses are detailed in the following sections:

- Section 3.8.1, *Aquifer Interconnections*
- Section 3.8.2, *Aquifer Discontinuity*

3.8.1 Aquifer Interconnections

Kimberly-Clark commented that EPA incorrectly characterized the shallow and the deep aquifers associated with the East Troy Contaminated Aquifer site as one "unconsolidated" aquifer. Additionally, Kimberly-Clark asserted that the term "hydraulic interconnection" is meaningless, as all subsurface water bearing zones are hydraulically interconnected to some degree.

Kimberly-Clark also commented that ground water contamination in the shallow aquifer does not migrate into the deeper aquifer beneath the Spinnaker property. Specifically, Kimberly-Clark asserted that "results of sampling conducted on the Spinnaker property both by consultants for Kimberly-Clark and by OEPA demonstrate that constituents present in shallow ground water beneath the property do not migrate to the deeper aquifer used by the City even directly beneath the Spinnaker property and, even if they did, cannot reach the City's wells in detectable concentrations." Kimberly-Clark referenced sample results associated with one particular monitoring well, RS06, which it identified as representing a "conservative location to detect constituents deeper within the shallow aquifer." Kimberly-Clark commented that "[n]one of the chlorinated chemicals of interest has been detected in any ground water sample collected

from this well [above the detection limit]" since its installation in 2000, and that these results "indicate that the chemicals of interest are restricted to the upper part of the shallow aquifer beneath the Spinnaker property and do not migrate vertically downward."

In response, the HRS documentation record for the East Troy Contaminated Aquifer site, as proposed, demonstrates that the upper and lower aquifers underneath the site are sufficiently hydraulically interconnected to evaluate them as a single aquifer (i.e., a single hydrologic unit) in evaluating the ground water migration pathway for the site. As also explained below, the aquifers were considered interconnected based on information that showed water transport between the two layers, not simply because there was a possible hydraulic interconnection between the two aquifers. While no sampling has shown that contamination transport has occurred from the upper to the lower aquifer underneath the Spinnaker property, as explained below, the HRS does not require such demonstration to show aquifer interconnection between the two aquifers.

HRS Section 3.0.1.2, *Aquifer Boundaries*, states:

> Combine multiple aquifers into a single hydrologic unit for scoring purposes if aquifer interconnections can be established for these aquifers. In contrast, restrict aquifer boundaries if aquifer discontinuities can be established.

HRS Section 3.0.1.2.1 *Aquifer interconnections*, states:

> Evaluate whether aquifer interconnections occur within 2 miles of the sources at the site. If they occur within this 2-mile distance, combine the aquifers having interconnections in scoring the site. . . . If data are not adequate to establish aquifer interconnections, evaluate the aquifers as separate aquifers.

The preamble to the final HRS under the heading *Aquifer Interconnections* (55 FR 51540, 51553) explains:

> Aquifer interconnections facilitate the transfer of ground water or hazardous substances between aquifers . . .

In practice, EPA has found that studies in the field to determine whether aquifers are interconnected in the vicinity of the site will generally require resources more consistent with remedial investigations than SIs, especially where installation of deep wells is necessary to conduct aquifer testing. Thus, EPA has in the past relied largely on existing information to make such determinations and the Agency finds it necessary to continue that approach.

The preamble goes on to list the following examples of the types of information useful in identifying aquifer interconnections, including:

- Literature or well logs that indicate that no lower relative hydraulic conductivity layer or confining layer separates the aquifers being assessed (e.g., presence of a layer with a hydraulic conductivity lower by two or more orders of magnitude);

- Literature or well logs that indicate that a lower relative hydraulic conductivity layer or confining layer that separates the aquifers is not continuous throughout the 2-mile radius (i.e., hydrogeological interconnections between the aquifers are identified);

- Evidence that withdrawal of water from one aquifer (e.g., pumping test, aquifer tests, well tests, etc.) affects water levels in another aquifer;

- Migration of constituents from one aquifer to another aquifer has been observed within the 2-mile radius.

Consistent with these examples in the preamble, the HRS documentation record for the East Troy Contaminated Aquifer site, as proposed, presents evidence both that the confining layer between the deep and shallow aquifers is not continuous throughout the 2-mile radius, and that withdrawal of water from one aquifer affects water levels in another aquifer.

Page 36 of the HRS documentation record as proposed, under the heading *Site-Specific Hydrogeology*, describes the hydrogeologic setting in the vicinity of the site.

> Glacial deposits in the Troy area are divided into an upper outwash and a lower outwash aquifer, which are separated by a lower-permeability unit. The upper aquifer is typically 10 to 40 feet (Refs. 7, pp. 11, 106-145; 8, pp. 116-121, 123, 128, 129; 15, pp. 36, 38, 40-93; 29). The lower aquifer is thicker than the upper aquifer and consists of buried bedrock valley sand and gravel deposits (Refs. 7, p. 11; 8, 122, 124-127). The lower aquifer has more interbeds of silt and clay; as a result, its bulk water-transmitting capabilities are generally less than the upper aquifer (Refs. 12A, p. 19; 29). The lower-permeability unit has considerable variability in depth and thickness, but in the area of Troy's east well field is typically found at depths between 70 and 100 feet below ground surface (bgs) and ranges in thickness from 5 to 25 feet (Refs. 4, p. 3; 7, p. 11; 8, pp. 122, 124-127).

The rationale for considering the two aquifers to be a single hydrologic unit (e.g., an unconsolidated aquifer) is presented on pages 36–37 of the HRS documentation record as proposed, under the heading *Aquifer Interconnection.*

> Hydraulic communication between these two aquifers is generally either directly through gaps in the confining unit (i.e. the confining unit is absent in some parts of the buried valley) or by means of leakage through the confining unit (Ref. 12A, p. 18; 29). In order to better understand surface and ground water interactions at the well fields, the riverbed hydraulic characteristics of the Great Miami River were investigated. This investigation revealed ground water flow to the river north of the West Well Field, and surface water flow from the river to the ground water system adjacent to and south of both well fields. This suggests that recharge of the aquifers from the river is induced by ground water drawdown caused by pumping (Refs. 12A, p. 19; 29). The geologic cross-section of the area is shown in [the] Panterra Report (Refs. 12A, pp. 20, 21; 29). In the vicinity of Troy, the confining unit between the upper and lower layer is not a continuous, laterally extensive unit, but rather consists of numerous irregularly shaped masses and lenses of fine-grained material of varying elevations interspaced with coarser deposits (Refs. 7, pp. 106-145; 8, pp. 116-129; 13, pp. 709, 743; 15, pp. 36, 38, 40-93; 29), and is absent over much of the east well field within one mile of the sources (Ref. 13, p. 709). Further, pump tests conducted at well 15 in Troy's east well field in 1994 and at Troy's east and west well fields in 2000 demonstrated there is hydraulic communication between shallow and deep sand and gravel deposits, where the till unit is present. Moreover the well field capture zone appeared to extend beneath the river, suggesting that recharge of the deeper sand and gravel deposits are induced by ground water drawdown caused by pumping (Ref. 13, p. 10).

EPA put forth two examples of why the upper and lower aquifers are interconnected in the HRS documentation record as proposed.

- The confining unit between the upper and lower aquifers is not continuous within 2 miles of the site sources

- Withdrawal of water from one aquifer (e.g., pumping tests) affect water levels in another aquifer.

In addition, while not specifically discussed in the HRS documentation record as proposed, there is a third example for why the two aquifers should be considered interconnected. As noted by Kimberly-Clark on page 12 of their comment letter in Footnote 2 and as discussed in the HRS documentation record as proposed on page 50, cis 1,2-DCE has been found in samples from wells in the East Troy Well field. These wells are screened in the lower aquifer. Therefore, this contamination must have migrated form the upper aquifer into the lower aquifer, also providing an example of why the two aquifers should be considered interconnected.

Kimberly-Clark's comments on aquifer interconnection are addressed in the following sections:

- Section 3.8.1.1, *Continuity of the Confining Layer*
- Section 3.8.1.2, *Pumping Tests*

3.8.1.1 Continuity of the Confining Layer

Kimberly-Clark did not specifically object to the assertion that the confining layer between the upper and the lower aquifers was not continuous within 2 miles of the site sources. However, it did state that, based on the projected storage coefficients in the Panterra Report (Reference 12A of the HRS documentation record as proposed) and a Site Remediation report prepared for Kimberly-Clark (Reference 17 of the HRS documentation record as proposed), the upper aquifer is unconfined, the lower aquifer is confined by definition, and there is an effective confining unit that restricts ground water flow from the shallow to the deeper aquifer. Kimberly-Clark also stated that the City of Troy's production wells in the East Well Field consistently show layers of low permeability materials (e.g., clay, silty clay, sandy clay) that form the confining unit.

In response, there may indeed be a difference in storage coefficients in parts of the two aquifers at the locations where the coefficients were determined, and the lower aquifer may overall have properties similar to a confined aquifer. However, this does not demonstrate that the confining layer between the two aquifers is continuous within 2 miles of the site sources. See HRS Section 3.0.1.2.1, *Aquifer Interconnections*, as discussed above.

Furthermore, Kimberly-Clark did not dispute that the cross-section in the Panterra report, cited in the HRS documentation record as proposed, shows the confining layer to be discontinuous in the vicinity of the site. In fact, Attachment E of Kimberly-Clark's comment submittal, *Response to Ohio EPA Review Comments Spinnaker Closure Report*, acknowledges that the layer is discontinuous. Page 18 of this report states:

> We do not dispute that this confining layer may be discontinuous but the cross sections that were developed from bore logs for multiple wells in the immediate vicinity both show the layer and suggest it is fairly continuous.

Therefore, Kimberly-Clark did not demonstrate that the confining layer was continuous within 2 miles of the site sources and in fact indicated that the confining layer in the vicinity of the site is thought to be "fairly continuous," from which it can be inferred that discontinuity may exist.

3.8.1.2 Pumping Tests

Kimberly-Clark argued that the 2000 pumping test used to assert the upper and lower aquifers are interconnected was technically flawed. It pointed out what it considered were several problems with the pumping test in its main comment document (Docket #: EPA-HQ-SFUND-2007-0690-0010), and also attached copies of the closure report from the Spinnaker remediation activity, which discusses inadequacies in the pumping tests (Attachment B of Kimberly-Clark's comment submittal), and its response to OEPA's comments on the closure report (Attachment E of Kimberly-Clark's comment submittal). Kimberly-Clark stated that this pumping test was not quantitatively analyzed by OEPA and, because of its poor design, *cannot* be quantitatively analyzed to determine ground water flow direction.

In response, while EPA acknowledges that the quality of the pumping tests is in dispute between Kimberly-Clark and the OEPA, Kimberly-Clark did not deny that the 2000 pumping test had an effect on the water level in the upper aquifer at the Spinnaker property, a factor that EPA used to document interconnection between the upper and lower aquifers.

Kimberly-Clark acknowledged that there was some communication between the upper and the lower aquifers during the 2000 pumping test due to the pumping of the City of Troy East Well Field wells. On page 10 of attachment E of its comment submittal, *Response to Ohio EPA Review Comments Spinnaker Closure Report*, Kimberly-Clark's representative stated:

> We don't disagree that there may be minor effects from the City's wells on the groundwater flow at the site.

Therefore, Kimberly-Clark did not dispute that withdrawal of water from the lower aquifer affected the water levels in the upper aquifer. Because hydraulic interconnection has been documented, it is not necessary to respond to Kimberly-Clark's other arguments that the pumping tests show interconnection does not occur.

3.8.2 Aquifer Discontinuity

Kimberly-Clark raised questions suggesting that the Great Miami River is an aquifer discontinuity at the site. Kimberly-Clark commented that the contamination in the shallow aquifer on the Spinnaker property does not migrate in detectable concentrations across or under the Great Miami River to the public supply wells in the Troy East Well Field that are in the deeper aquifer. Kimberly-Clark noted that seven test borings in the lower aquifer installed in 1994 (prior to remediation of the Spinnaker property) between the Spinnaker property and the Great Miami River show that concentrations of VOCs in the shallow aquifer decrease rapidly beyond the downgradient Spinnaker property line.

Kimberly-Clark asserted that ground water flow direction in the shallow aquifer responds to the Great Miami River and not the City of Troy's production wells in the East Well Field. It pointed out that ground water potentiometric maps of the west end of the Spinnaker facility demonstrate that ground water flow direction is from southwest to northeast, whereas the potentiometric maps of the east end of the facility (closest to the City's production wells) show ground water flow from west-northwest to east-southeast (i.e., away from the wells). Kimberly-Clark stated that these data demonstrate the ground water flow actually turns away from the City of Troy East Well Field at the same time the Great Miami River also turns away.

In response, the HRS evaluation of the site does not depend on documentation that contamination crosses from one side of the Great Miami River to the other, only that the river is not an aquifer discontinuity that physically blocks ground water from migrating under the river to the East Troy Well field. HRS Section 3.0.1.2.2, *Aquifer discontinuities*, defines when a feature such as a river is considered a discontinuity:

> An aquifer discontinuity occurs for scoring purposes only when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4 mile target distance limit, thereby creating a continuous boundary to ground water flow within this limit. If two or more aquifers can be combined into a single hydrologic unit for scoring purposes, an aquifer discontinuity occurs only when the structure or feature entirely transects the boundaries of this single hydrologic unit. [emphasis added]

As detailed on pages 35–36 of the HRS documentation record as proposed, EPA evaluated the combined upper and lower aquifers as one, unconsolidated aquifer. According to the HRS, the Great Miami River would have to entirely transect the entire interconnected aquifer system to be considered a discontinuity. In fact, the Great Miami River does not entirely transect the upper aquifer, let alone the combined upper and lower aquifers.

The geologic cross section of the Great Miami River, Figure 4, on page 20 of Reference 12A of the HRS documentation record as proposed, shows that the Great Miami River does not entirely transect the upper aquifer at the site. Figure 3 of Reference 12a (page 9) shows the location of the cross section relative to the land surface.

Figure 4 of Reference 12A is a north-south cross section in the vicinity of the site. The site and the City of Troy East Well Field is located near wells TW 1 and 4E (see Figure 3 of Reference 12A for well locations and the Site Location map, Figure 1 of the HRS documentation record as proposed, for the general site location) and the site is nearest to the northern most location where the cross section crosses the Great Miami River. The cross section shows that at the point where the cross section crosses Great Miami River, the upper aquifer is approximately 40 feet thick while the river depth (including the river valley) is shown as only 10 feet. Therefore based on this cross section the river does not entirely transect the upper or the combined aquifer.

To confirm this finding, EPA has obtained actual field measurements of the depth of the Greater Miami River at a U.S. Geological Survey (USGS) gaging station in the City of Troy (added as attachment A to this support document). On several dates from 2005 through 2007, the Great Miami River depth ranged from 1.40 to 10.40 feet deep at this location. This range of river depth, when compared to the range of thickness of the upper aquifer of 10 to 40 feet in the vicinity of the site (see page 36 of the HRS documentation record as proposed), supports the conclusion that the Great Miami River does not entirely transect either the upper aquifer or the combined upper and lower aquifers. This information has been added as an attachment to this support document.

Furthermore, Kimberly Clark presented no information indicating the river entirely transects the upper aquifer or the combined upper and lower aquifers.

Therefore, the HRS evaluation correctly did not consider the Great Miami River to be a discontinuity that would block ground water from migrating from the site under the river to the Troy East Well Field.

3.9 Likelihood of Release

Kimberly-Clark challenged the identification of two observed releases of TCE based on samples collected from the Spinnaker Property, one by direct observation and a second based on chemical analysis.

3.9.1 Observed Release by Direct Observation

Kimberly-Clark commented that concentrations of PCE and TCE in soil on the Spinnaker property documenting the identification of an observed release by direct observation "do not contribute significantly to concentrations of these constituents in groundwater." Kimberly-Clark also commented that, although concentrations of PCE and TCE remain in the soil on the Spinnaker property, computer leaching modeling of PCE and TCE in soil on the Spinnaker property demonstrates that these concentrations do not "impact groundwater to a degree that could result in groundwater concentrations exceeding Maximum Contaminant Limits (MCLs) on the Spinnaker property," even if "the contamination present in the shallow aquifer at the Spinnaker property is in the same aquifer as City's wells."

In response, the HRS documentation record for the East Troy Contaminated Aquifer site correctly identifies an observed release by direct observation of TCE from TCE-contaminated soils on the Spinnaker property in accordance with HRS requirements. As discussed in HRS Section 2.3, *Likelihood of release*, an observed release by direct observation is established by direct observation of the release of a hazardous substance into the media being evaluated. Per HRS Section 3.1.1, *Observed Release*, to establish the observed release to an aquifer, it is necessary to demonstrate that the site has released a hazardous substance to the aquifer based on either a direct observation or chemical analysis. Further, HRS Section 3.1.1, *Observed Release*, specifies that an observed release via direct observation can be established if:

> . . . a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer.

The HRS does not require that the observed release of TCE contribute significantly to the concentration of TCE in ground water underneath the Spinnaker property or in the City of Troy's production wells, or that it be shown to cause contamination above any regulatory limit such as an MCL. Furthermore, the HRS scoring did not depend in any way on identification of PCE in the soil on the Spinnaker property entering into the ground water.

As documented on page 37 of the HRS documentation record as proposed, an observed release by direct observation to the ground water migration pathway in the unconsolidated aquifer was established at the Spinnaker property, as evidenced by detection of TCE in soil samples collected below the water table on the property. Kimberly-Clark did not contest this finding. This documentation adequately establishes an observed release of TCE by direct observation per the requirements specified in HRS Section 3.1.1, *Observed Release*. Additionally, no observed release to ground water by direct observation of PCE was identified.

Furthermore, Kimberly-Clark's statement that the concentration levels in the ground water underneath the Spinnaker property are above MCLs is not relevant to identifying an observed release. On July 16, 1982, when responding to public comments on the proposed (original) HRS (47 FR 31188), and again on September 8, 1983 (48 FR 40665), the Agency rejected the idea that releases within regulatory limits should not be considered "observed releases" under the HRS. As the Agency noted in 1982,

> emission or effluent limits do not necessarily represent levels which cause no harm to public health or the environment. These limitations are frequently established on the basis of economic impacts or achievability.

By contrast, an observed release represents a 100 percent likelihood that substances can migrate from the site (47 FR 31188, July 16, 1982).

Section 2.3 of the HRS (55 FR 51589, December 14, 1990) states that an observed release can be established either by direct observation or by chemical analysis. An observed release by direct observation has occurred when "a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer." Even though levels of the hazardous substances may be lower than regulatory limits, an observed release has nevertheless occurred if the concentration of the hazardous substances is above the detection limit. The HRS does, however, consider whether releases are above regulatory limits in evaluating target populations, increasing by a factor of 10 the weight assigned populations exposed to contaminants above the limits. See Section 3.3.2.2, Level I concentrations, of the HRS.

Of course, the observed release factor alone is not intended to reflect the hazard presented by the particular release. Instead, the hazard of the site is approximated by the total HRS score, which incorporates the observed release factors with other factors such as waste characteristics (including waste quantity, toxicity and mobility) and targets. This total HRS score reflects the hazard of the site relative only to the other sites that have been scored. The actual degree of contamination and its effects are more fully determined during the remedial investigation that typically follows listing.

3.9.2 Observed Release by Chemical Analysis

Kimberly-Clark objected to the identification of an observed release of TCE by chemical analysis based on samples taken from wells on the Spinnaker property. Specifically, it objected to the background level chosen to reflect upgradient conditions and the attribution of the increase in TCE concentration to a source on the Spinnaker property. Kimberly-Clark asserted that PCE was degrading to TCE as contamination from another source passed under the Spinnaker property, and this was the cause of the increase in TCE levels under the Spinnaker property. These comments are addressed in the following sections:

- Section 3.9.2.1, *Background*
- Section 3.9.2.2, *Attribution*

3.9.2.1 Background

Kimberly-Clark asserted the present TCE contamination under the Spinnaker property is due to biodegradation of a PCE plume and that the background level for TCE does not reflect this. Kimberly-Clark also commented that PCE is consistently detected in samples from background wells on the Spinnaker property, and, therefore, a statement in the HRS documentation record as proposed that VOCs were not detected above the reporting limit is inaccurate.

In response, the identification of an observed release of TCE by chemical analysis, based on samples from wells on the Spinnaker property is consistent with HRS requirements. The statement in the HRS documentation record as proposed that no VOCs were found above the reporting limits in the background wells in the sample set used to establish background levels of TCE is incorrect and has been removed from the HRS documentation record at promulgation. According to Reference 14 (see pages 42–43 of the HRS documentation record as proposed), PCE was found at concentrations of 14.6 µg/L and 14.4 µg/L in samples EEIB4 and GZAB1, respectively. However, these data have no bearing on the identification of an observed release of TCE or the background level of TCE used, as explained below.

The HRS identifies the requirements for establishing an observed release in HRS Section 2.3, *Likelihood of release*. It states that an observed release can be established:

> either by direct observation of the release of a hazardous substance into the media being evaluated . . . or by chemical analysis of samples appropriate to the pathway being evaluated.

HRS Section 2.3 further states for establishing an observed release by chemical analysis for all media, that:

> [t]he minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level. Further, some portion of the release must be attributable to the site. [emphasis added]

Table 2-3 of HRS contains the criteria for establishing a significant increase of the release substances[4].

As discussed on page 38 of the HRS documentation record as proposed, "[a]n observed release, by chemical analysis, to the ground water migration pathway in the unconsolidated aquifer [was] established on the Spinnaker property . . . based on the analysis of ground water samples collected and analyzed from the monitoring wells and municipal drinking wells." Background wells for establishing an observed release by chemical analysis for TCE on the Spinnaker property were wells that were screened in the same unconsolidated aquifer as the contaminated wells, and that were located upgradient of the release wells for TCE. TCE was found at concentrations of 0.46 µg/L and 0.481 µg/L in samples EEIB4 and GZAB1 from the background wells, respectively, which were above the MDLs but below the reporting limits for the analyses. TCE concentration in the six samples from the release wells ranged from 1.46 to

[4] While Kimberly-Clark did not raise the issue in its comments, for completeness, EPA addresses the use of the reporting limit (RL) in establishing an observed release by chemical analysis at this site. HRS Table 2-3 specifies use of the detection limit (DL) in place of the Sample Quantitation Limit (SQL) when non-Contract Laboratory Program data are used in HRS evaluations. The DL (more specifically, the method detection limit (MDL), see HRS Section 1.1, *Definitions*) is the lowest amount of a substance that can be detected with certainty. For this site, in samples where the DL was not available, EPA used the laboratory's reporting limit (RL) to establish observed releases by chemical analysis. The RL is commonly defined as the lowest contaminant concentration at which a laboratory can report the concentration with confidence; therefore, the RL is by definition at or above the DL.

The use of an RL in situations when a DL is not available is consistent with the second of two criteria in HRS Table 2.3 for establishing an observed release (only one criterion must be met), which provides that if the background concentration is above the detection limit, then the release concentration must be three times the background level. This criterion is met when the RL, but not the DL is known, and when the background sample concentration is known only to be at or lower than the RL and the release sample concentration is three times the RL. This situation meets this criterion because even though the actual background sample concentration could be at the RL, between the RL and the DL, or lower than the DL; the release sample concentration would also be 3 times any concentration between the RL and DL. When the background sample is above the RL, an observed release is established when the release sample is three times or more above the background concentration.

EPA has re-examined the establishment of observed releases to ground water and the association of hazardous substances with sources in the HRS package in instances when the DL is not presented. While two release samples (or in some instances one or more substances in a release sample or in a sample used to associate hazardous substance with sources) do not meet the cited Table 2.3 criterion, multiple other release and source samples containing the same substances meet the criterion. Therefore, even if the samples and substances without a listed DL that are not 3 times the background concentration were removed from the scoring, neither the likelihood of release value, the waste characteristics value, nor the site score would change. (See HRS Sections 2.3, *Likelihood of release*, 2.2.3, *Identify hazardous substances available to a pathway* and 3.2, *Waste characteristics* (and its subsections).

5.92 µg/L (see page 40 of the HRS documentation record as proposed). Therefore, a significant increase was established in samples where TCE was measured at three times or more above these background concentrations and greater than the reporting limit.

For the evaluation of PCE ground water contamination at the site, samples GP-10 and GP-11 from background wells that are farther upgradient of the Spinnaker property were used. These samples from background wells support the observed release of PCE into the ground water plume evaluated as Source 2 (see pages 40–43 of the HRS documentation record as proposed).

While it is possible that PCE has degraded to TCE under the Spinnaker property, this possibility does not change the fact that HRS significant increase requirements for establishing an observed release for PCE have been met. Kimberly-Clark did not challenge this fact.

In addition, TCE was found in contaminated soil in direct contact with ground water (see section 3.9.1, *Observed Release by Direct Observation,* of this support document), and, therefore, at least some of the TCE found in the release wells could be from this observed release and not from the degradation of PCE. Therefore, EPA correctly identified an observed release of TCE based on samples from the Spinnaker property.

3.9.2.2 Attribution

Kimberly-Clark commented that PCE and TCE contamination cannot be attributed to just the contaminated soil on the Spinnaker property. Kimberly-Clark asserted that carbon isotope analysis has shown that contamination from other sources enters the property, and that computer leaching models demonstrated that contaminated soil concentrations could not have resulted in the levels of contamination found in the ground water on the Spinnaker property.

In response, the observed release of TCE was attributed at least in part to a release from a source on the Spinnaker property. This identification does not require that the TCE from this observation contribute significantly to the concentration of TCE in the ground water underneath the Spinnaker property, or that possible contamination from elsewhere be conclusively ruled out. Regarding PCE, no observed release of PCE was attributed specifically to any sources on the Spinnaker property.

The HRS identifies the requirements for establishing an observed release in HRS Section 2.3, *Likelihood of release,* and specifically for an observed release to ground water in HRS Section 3.1.1, *Observed release*. HRS Section 2.3 states that an observed release can be established "either by direct observation of the release of a hazardous substance into the media being evaluated . . . or by chemical analysis of samples appropriate to the pathway being evaluated." It further states for establishing an observed release by chemical analysis for all media, that:

> [t]he minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level. Further, some portion of the release must be attributable to the site. [emphasis added]

For establishing an observed release by chemical analysis for ground water, HRS Section 3.1.1 states that:

> [s]ome portion of the significant increase must be attributable to the site to establish the observed release. [emphasis added]

(Table 2-3 of HRS Section 2.3 contains the criteria for establishing a significant increase in the release substances.)

As documented on pages 37–38 of the HRS documentation record as proposed, an observed release by direct observation of TCE to the ground water migration pathway was established at the Spinnaker property (Source 1), as evidenced by detection of TCE in soil samples collected below the water table on the property. This documentation adequately establishes that at least some portion of the observed release by chemical analysis of TCE can be attributed to the contaminated soil on the Spinnaker property as discussed on page 44 of the HRS documentation record as proposed.

EPA notes that as documented on pages 40–44 of the HRS documentation record as proposed, an observed release of PCE by chemical analysis to the ground water migration pathway was established for the PCE-contaminated ground water plume with no identified source(s) (Source 2) by showing a significant increase of PCE in samples from contaminated wells compared to those from background wells. As noted previously in section 3.7.1 of this support document, no additional attribution is required for an observed release with no identified source(s).

PCE was also found in the contaminated soils on the Spinnaker property (Source 1), but the HRS documentation record did not evaluate an observed release by direct observation of PCE from this source. However, it was noted on page 44 of the HRS documentation record that "PCE ground water contamination extends well upgradient of the Spinnaker property, and many of the highest PCE concentrations in the ground water are in this upgradient portion of the PCE plume . . . indicat[ing] that there are other sources of the PCE ground water contamination and that PCE releases have comingled in the area." The evaluation of how much PCE in the contaminated ground water is attributable to the contaminated soil source on the Spinnaker property is beyond the scope of an HRS observed release evaluation.

Hence, the attribution of TCE and PCE to the releases documented at the East Troy Contaminated Aquifer site is consistent with HRS requirements.

3.10 Targets

Kimberly-Clark made several comments that in the aggregate questioned the inclusion of the City of Troy's production wells on the HRS scoring of the site. Kimberly-Clark questioned whether EPA had accurately asserted that there is an interconnection between the upper aquifer at the Spinnaker property and the lower aquifer both on the property as well as across the Great Miami River, where the city's production wells are located. It also questioned if the releases could reach the East Troy Well Field in sufficient concentrations to pose a significant threat. It asserted that a lack of interconnection between the two aquifers would mean that the city wells cannot be considered as potential or actual targets. While these comments are individually addressed elsewhere in the document (see Sections 3.5, *Actual Risk*, and 3.8, *Aquifer Delineation* of this support document), the following response addresses comments in the context of the HRS target evaluation.

In response, the HRS documentation record has correctly evaluated the City of Troy municipal wells as potentially contaminated target wells at the site. HRS Section 3.3.2.4, *Potential contamination*, directs the site scorer to "[d]etermine the number of people served by drinking water from points of withdrawal subject to potential contamination." The HRS explains that a "[t]arget is subject to a potential release (that is, [a] target is not associated with actual contamination for that pathway or threat)." [HRS Section 2.5, *Targets*]. As discussed on pages 49 and 50 of the HRS documentation record as proposed, no drinking water wells are evaluated as actually contaminated target wells (Level I or Level II target wells).

However, the City of Troy obtains drinking water from two municipal well fields, East Well Field and West Well Field, within the Target Distance Limit (TDL) for this site.

As previously discussed in Section 3.8.1, *Aquifer Interconnections*, of this support document, the shallow and deep aquifers are interconnected within 2 miles of the sources at the site and, thus, are correctly evaluated as one hydrologic unit or one aquifer system. Having established this interconnection, the HRS directs the scorer to evaluate whether aquifer discontinuities occur within the 4-mile TDL. If no such discontinuities are found, wells within the 4-mile TDL can be evaluated as eligible targets (see HRS Sections 2.5, *Targets*; 3.0.1.1, *Ground Water Target Distance Limit*; 3.0.1.2, *Aquifer Boundaries*; 3.0.1.2.1, *Aquifer Interconnections*; and 3.0.1.2.2, *Aquifer Discontinuities*). Although Kimberly-Clark has contended that the Great Miami River is an aquifer discontinuity, as discussed above (see Section 3.8.2, *Aquifer Discontinuity,* of this document), EPA consider that the geology at the Great Miami River is not an aquifer discontinuity such that ground water cannot flow beyond this location. EPA notes that HRS Section 3.0.1.2.2, *Aquifer Discontinuities*, defines an aquifer discontinuity that would effectively prohibit evaluation of targets beyond this discontinuity as follows:

> An aquifer discontinuity occurs for scoring purposes only when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4-mile target distance limit, thereby creating a continuous boundary to ground water flow within this limit. If two or more aquifers can be combined into a single hydrogeologic unit for scoring purposes, an aquifer discontinuity occurs only when the structure or feature entirely transects the boundaries of this single hydrogeologic unit.

As stated on page 36 of the HRS documentation record as proposed and discussed in detail in this support document, the geologic conditions at the Great Miami River in East Troy document that the river is not an aquifer discontinuity. The river does not entirely transect the aquifer within the 4-mile distance as measured from the site sources. Thus, because the Great Miami River is not an aquifer discontinuity within the TDL, wells located north of the Great Miami River that are within the 4-mile TDL are eligible target wells. All 10 wells in the Troy East and West Well Fields fall within this 4-mile TDL and, therefore, are considered eligible target wells.

As discussed on pages 49–50 of the HRS documentation record, no drinking water wells are evaluated as Level I or Level II target wells (see also section 3.7, *Conceptual Site Model*, of this support document). However, the City of Troy obtains drinking water from two municipal well fields, the East Well Field and West Well Field, within the TDL for this site. Within a mile of the sources at the site and thus within the 4-mile TDL, there are 10 municipal drinking water wells that are evaluated as potentially contaminated target wells, of which 5 are located in the East Troy Well Field and 5 are located in the West Troy Well Field (see pages 50–51 of the HRS documentation record as proposed). All of these wells are screened in the buried bedrock valley sand and gravel (lower) aquifer evaluated at this site (see page 36 of the HRS documentation record as proposed).

In summary, the City of Troy municipal wells evaluated as potentially contaminated target wells all withdraw from the aquifer unit evaluated at this site. These wells withdraw from the lower section of the aquifer unit and are 68 to 124 feet deep. The sand and gravel lower aquifer ranges in depths from 75 feet to greater than 125 feet deep (see page 36 of the HRS documentation record as proposed; pages 3–4 of Reference 4 of the HRS documentation record as proposed; and pages 23–24 of Reference 27 of the HRS documentation record as proposed). Considering that the municipal wells withdraw from the lower section of the aquifer unit, are within the TDL and north of the site, and that the Great Miami River does not transect the aquifer system such that it creates an aquifer discontinuity, the City of Troy municipal wells are within the HRS requirements for eligible targets for the ground water pathway at this site. They were correctly considered as potentially contaminated targets at the site.

4. Conclusion

The original HRS score for this site was 50.00. Based on the above response to comments, the score remains unchanged. The final scores for the East Troy Contaminated Aquifer site are:

Ground Water: 100.00
Surface Water: Not Scored
Soil Exposure: Not Scored
Air Pathway: Not Scored
HRS Score: 50.00

STREAM DEPTH AND WIDTH OF THE GREAT MIAMI RIVER IN TROY, OHIO

Miami Conservancy District (MCD) obtained measurements of depth across the Great Miami River about 200 or 300 yards downstream of the low dam, adjacent to the East Well Field area, and near a U.S. Geological Survey (USGS) gaging station (ID No. 03262700, lat/long: 40.040278, -84.197778) during a time period from 2005 to 2007. MCD took these measurements using an AquaCalc 5000 meter by wading across the stream starting from the well field side of the river. Measurements are recorded in units of feet. A top set rod was used to hold the meter, and the rod was placed on the stream bottom and a measurement was collected. On two days (2/9/2006 and 12/7/2006), because of high flow conditions, the river was too deep to cross (9 to 10+ feet), and a cable system on the Market Street Bridge above the low dam was used to collect the measurement. The width of the river ranged from 55 to 385 feet, and the maximum depth of the river was 1.40 to 10.40 feet. The following table is a summary of the data obtained by MCD. Pages that follow contain an excerpt from the instrument instruction manual, and instrument output data.

Date	Year	Month	River Width (feet)	Max Depth (feet) and Distance from the River Bank Where Measurement Taken
2/28/2005	2005	2 (Feb)	160	2.90 (at 73 ft)
4/20/2005	2005	4 (Apr)	167	2.80 (at 69-73 ft)
6/7/2005	2005	6 (Jun)	130+	3.60 (at 48 ft)
8/2/2005	2005	8 (Aug)	68	1.60 (at 35 ft)
10/7/2005	2005	10 (Oct)	191	2.25 (at 104 ft)
12/5/2005	2005	12 (Dec)	214	2.60 (at 84 ft)
2/9/2006	2006	2 (Feb)	384	9.70 (at 323 ft)
4/11/2006	2006	4 (Apr)	194	3.10-3.15 (at 55-76 ft)
6/14/2006	2006	6 (Jun)	139	2.13 (at 104.50 ft)
8/7/2006	2006	8 (Aug)	148	2.05 (at 74 ft)
10/13/2006	2006	10 (Oct)	146	2.10 (at 67 ft)
12/7/2006	2006	12 (Dec)	385	10.40 (at 324 ft)
2/20/2007	2007	2 (Feb)	144	2.04 (at 72 ft)
4/9/2007	2007	4 (Apr)	160	2.40 (at 78 ft)
6/26/2007	2007	6 (Jun)	87	1.99 (at 56-59 ft)
8/1/2007	2007	8 (Aug)	57	1.40 (at 34.50 ft)
9/19/2007	2007	9 (Sep)	55	1.60 (at 37 ft)

AquaCalc Pro Output Header Description

<csv>		Computer File Type Identifying Comma Separated Value		
AquaCalc Pro (tm) by JBS Instruments (c)2002		Header beginning		
		(blank line)		
S/N:	0000006F2B19	Current Meter Identification Number	Default	
Firmware Version:	AQP-1V1.1.1	Firmware Version Identification	Default	
File Version:	V1.4	File Version	Default	
		(blank line)		
Gage ID:	1534000.709	Gaging Station Identification Number	User	15,a,n
User ID:	MARK JONES	Hydrogapher Identification	User	15, a,n
Meter name:	A94156	Meter Name	User	10, a,n
Meter id:	A94156	Meter Identification Number	User	
Meter type:	PAA11	Meter Type	User	n/a
Meter Standard:	SAE	Measurment Type SAE=English/SI=Metric	User	n/a
Meter Revs/Pulses:	1/1	Ratio of Meter Revolutions per pulse	User	n/a

Meter Const.S1:	2.2048	Meter Constant 1: m1 – slope (m) of line segment 1 where Velocity = (m * rev/sec) +b	User / Default standard meters	1.4, n
Meter Const.O1:	0.0178	Meter Constant 1: O1 – Offset (b) of line segment 1 where Velocity = (m * rev/sec) +b		1.4, n
Meter Const.C1:	0	Velocity changeover point of line segment 1 to line segment 2		2.2, n
Meter Const.S2:	0	Meter Constant 2: O2 – Offset (b) of line segment 2 where Velocity = (m * rev/sec) +b		1.4, n
Meter Const.O2:	0	Meter Constant 2: m2 – slope (m) of line segment 2 where Velocity = (m * rev/sec) +b		1.4, n
Meter Const.C1:	0	Velocity changeover point of line segment 2 to line segment 3		2.2, n
Meter Const.S3:	0	Meter Constant 3: m3 – slope (m) of line segment 3 where Velocity = (m * rev/sec) +b		1.4, n
Meter Const.O3:	0	Meter Constant 3: O3 – Offset (b) of line segment 3 where Velocity = (m * rev/sec) +b		1.4, n
Beg Time:	02/23/04 09:41	Date and Time at the Beginning of the Measurement	Calculated	
End Time:	02/23/04 10:16	Date and Time at the end of the Measurement	Calculated	
Meas Time:	0.58	Time for Duration of the entire Measurement	Calculated	

Section Diff:	-37.32	Percent difference from Estimated Q	Calculated	
Beg Gage height:	0	Inside Gage Height Reading from Inside Gage at Beginning of Measurement	User	4.2, n
End Gage height:	0	Inside Gage Height Reading from Inside Gage at End of Measurement	User	4.2, n
Beg Staff height:	0	Stage Height Reading from Staff Gage at Beginning of Measurement	User	4.2, n
End Staff height:	0	Stage Height Reading from Staff Gage at End of Measurement	User	4.2, n
Estimated Q:	230	Estimated Discharge - based on Stage Height and Rating Curve / Table	Calculated	6.2, n
Adjusted Q:	230	Adjusted Estimated Discharge based on Stage Height and Rating Curve / Table. (This value is entered during measurement and changes warning messages.)	User	6.2, n
Measure time:	40	User recommended Measurement Time in Seconds (1-99)	User	2, n
Measure standard:	SAE	Measurement Units – SAE=English / SI=Metric	User	
Measure equipment:	TopSet Rod		User	
Sounding Weight:	NA			
Measure ice:	No	Identifies whether Ice Draft Mode used		
Flood Measurement:	No	Identifies whether .2 Flood Mode used	User	
Flood Coef:	0			
Max Vertical Q:	5%			2n

			1.4, n
Percent Slope:	0		
Measure Start at:	REW	Beginning Edge of Water / Bank: REW:Right Edge of Water / LEW: Left Edge of Water	User
Vertical Count:	22	Number of Verticals in the Measurement	Calculated
Section Velocity:	0.74	Mean Velocity	Calculated
Section Width:	144	Width in Feet of the Stream not including Width of Piers, Islands, etc.	Calculated
Section Area:	261.65	Cross-section Area	Calculated
Section Q:	192.68	Total Discharge of Water	Calculated
Section Diff:	-37.32		Calculated
Section Pct Err:	-16.20%	Percent difference from Estimated Q	Calculated
Section Quality:	na		User
Section WetPerim:	145.46		Calculated
Section Hyd Rad:	1.8		Calculated
Section Manning:	0		Calculated
Section Chezy:	0		Calculated

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.0.8
File Version:, V1.4

Gage ID:, 03262700
User ID:, MCD
Meter name:, PAA 11 STD
Meter id:, 255272
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 02/28/05 12:21
End Time:, 02/28/05 13:12
Meas Time:, 0.85
Section Diff:, 756.92
Beg Gage height:, 3.24
End Gage height:, 0.00
Beg Staff height:, 3.19
End Staff height:, 0.00
Estimated Q:, 0.00
Adjusted Q:, 0.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 30
Section Velocity:, 2.84
Section Width:, 158.00
Section Area:, 266.26
Section Q:, 756.92
Section Diff:, 756.92
Section Pct Err:, 0.0%
Section Quality:, na
Section WetPerim:, 158.17
Section Hyd Rad:, 1.68
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT, DIST,TDPTH,IDRFT,EDPTH,OBS, TIME,REVS,HA,HC:VF,METH,CLOCK, MVEL, OVEL, VVEL, SSAREA, SSQ, SSPCT, FLAGS
1, 2.00, 0.00, 0.00, 0.00, E, , , , , ,12:21, , , 0.00, 0.00, 0.00, 0.0%,
2, 8.00, 0.50, 0.00, 0.50, o6,40.12, 11, 0, 1.00,1.00,12:22, 0.62, 0.62, 0.62, 3.75, 2.33, 0.3%,
3, 17.00, 1.00, 0.00, 1.00, o6,40.58, 47, 0, 1.00,1.00,12:24, 2.57, 2.57, 2.57, 8.00, 20.57, 2.7%,
4, 24.00, 1.12, 0.00, 1.12, o6,40.61, 56, 0, 1.00,1.00,12:25, 3.06, 3.06, 3.06, 7.84, 23.98, 3.2%,
5, 31.00, 1.24, 0.00, 1.24, o6,40.66, 62, 0, 1.00,1.00,12:26, 3.38, 3.38, 3.38, 8.06, 27.24, 3.6%,
6, 37.00, 1.43, 0.00, 1.43, o6,40.40, 68, 0, 1.00,1.00,12:28, 3.73, 3.73, 3.73, 7.86, 29.33, 3.9%,
7, 42.00, 1.80, 0.00, 1.80, o6,40.51, 68, 0, 1.00,1.00,12:29, 3.72, 3.72, 3.72, 8.10, 30.12, 4.0%,
8, 46.00, 2.13, 0.00, 2.13, o6,40.06, 68, 0, 1.00,1.00,12:31, 3.76, 3.76, 3.76, 7.45, 28.03, 3.7%,
9, 49.00, 2.43, 0.00, 2.43, o6,40.47, 65, 0, 1.00,1.00,12:32, 3.56, 3.56, 3.56, 7.29, 25.95, 3.4%,
10, 52.00, 2.60, 0.00, 2.60, o2,40.14, 67, 0, 1.00,1.00,12:35, 3.70, 3.70
10, 52.00, 2.60, 0.00, 2.60, o8,40.60, 57, 0, 1.00,1.00,12:34, 3.11, 3.11, 3.41, 9.10, 30.99, 4.1%,
11, 56.00, 2.65, 0.00, 2.65, o2,40.39, 67, 0, 1.00,1.00,12:37, 3.68, 3.68
11, 56.00, 2.65, 0.00, 2.65, o8,40.74, 59, 0, 1.00,1.00,12:38, 3.21, 3.21, 3.44, 9.27, 31.93, 4.2%,
12, 59.00, 2.65, 0.00, 2.65, o2,40.04, 65, 0, 1.00,1.00,12:40, 3.60, 3.60
12, 59.00, 2.65, 0.00, 2.65, o8,40.27, 58, 0, 1.00,1.00,12:39, 3.19, 3.19, 3.40, 8.61, 29.24, 3.9%,
13, 62.50, 2.70, 0.00, 2.70, o2,40.36, 66, 0, 1.00,1.00,12:42, 3.62, 3.62
13, 62.50, 2.70, 0.00, 2.70, o8,40.51, 59, 0, 1.00,1.00,12:43, 3.23, 3.23, 3.43, 9.45, 32.38, 4.3%,
14, 66.00, 2.75, 0.00, 2.75, o2,40.57, 67, 0, 1.00,1.00,12:45, 3.66, 3.66
14, 66.00, 2.75, 0.00, 2.75, o8,40.25, 59, 0, 1.00,1.00,12:44, 3.25, 3.25, 3.45, 9.63, 33.25, 4.4%,
15, 69.50, 2.75, 0.00, 2.75, o2,40.38, 66, 0, 1.00,1.00,12:47, 3.62, 3.62
15, 69.50, 2.75, 0.00, 2.75, o8,40.20, 60, 0, 1.00,1.00,12:48, 3.31, 3.31, 3.47, 9.63, 33.35, 4.4%,
16, 73.00, 2.90, 0.00, 2.90, o2,40.54, 65, 0, 1.00,1.00,12:50, 3.55, 3.55
16, 73.00, 2.90, 0.00, 2.90, o8,40.02, 56, 0, 1.00,1.00,12:49, 3.10, 3.10, 3.33, 10.15, 33.78, 4.5%,
17, 76.50, 2.80, 0.00, 2.80, o2,40.24, 61, 0, 1.00,1.00,12:52, 3.36, 3.36

```
17,    76.50, 2.80, 0.00, 2.80, o8,40.53,  59, 0, 1.00,1.00,12:53, 3.23, 3.23, 3.29,     9.80,    32.28, 4.3%,
18,    80.00, 2.60, 0.00, 2.60, o2,40.02,  54, 0, 1.00,1.00,12:55, 2.99, 2.99
18,    80.00, 2.60, 0.00, 2.60, o8,40.61,  58, 0, 1.00,1.00,12:54, 3.17, 3.17, 3.08,     9.75,    30.03, 4.0%,
19,    84.00, 2.32, 0.00, 2.32, o6,40.51,  54, 0, 1.00,1.00,12:56, 2.96, 2.96, 2.96,    11.60,    34.30, 4.5%,
20,    90.00, 2.32, 0.00, 2.32, o6,40.47,  47, 0, 1.00,1.00,12:57, 2.58, 2.58, 2.58,    12.76,    32.90, 4.3%,
21,    95.00, 2.32, 0.00, 2.32, o6,40.67,  39, 0, 1.00,1.00,12:59, 2.13, 2.13, 2.13,    12.76,    27.21, 3.6%,
22,   101.00, 2.12, 0.00, 2.12, o6,40.07,  30, 0, 1.00,1.00,13:00, 1.67, 1.67, 1.67,    13.78,    22.99, 3.0%,
23,   108.00, 1.90, 0.00, 1.90, o6,40.19,  33, 0, 1.00,1.00,13:02, 1.83, 1.83, 1.83,    13.30,    24.31, 3.2%,
24,   115.00, 1.82, 0.00, 1.82, o6,40.88,  43, 0, 1.00,1.00,13:03, 2.34, 2.34, 2.34,    12.74,    29.77, 3.9%,
25,   122.00, 1.64, 0.00, 1.64, o6,40.71,  48, 8, 0.99,1.00,13:04, 2.62, 2.59, 2.59,    11.48,    29.75, 3.9%,
26,   129.00, 1.48, 0.00, 1.48, o6,40.12,  52,11, 0.98,1.00,13:06, 2.88, 2.82, 2.82,    10.36,    29.19, 3.9%,
27,   136.00, 1.26, 0.00, 1.26, o6,40.62,  51,11, 0.98,1.00,13:07, 2.79, 2.73, 2.73,     9.45,    25.80, 3.4%,
28,   144.00, 1.04, 0.00, 1.04, o6,40.64,  51,14, 0.97,1.00,13:09, 2.78, 2.70, 2.70,     8.84,    23.88, 3.2%,
29,   153.00, 0.68, 0.00, 0.68, o6,43.63,  12,53, 0.60,1.00,13:11, 0.62, 0.37, 0.37,     5.44,     2.04, 0.3%,
30,   160.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,13:12,     ,     , 0.00,     0.00,     0.00, 0.0%,
→
```

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,000000C2949C
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, 03262700
User ID:, MCD 2
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 04/20/05 14:28
End Time:, 04/20/05 15:28
Meas Time:, 1.00
Section Diff:, 48.77
Beg Gage height:, 0.00
End Gage height:, 0.00
Beg Staff height:, 2.69
End Staff height:, 0.00
Estimated Q:, 360.00
Adjusted Q:, 360.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 24
Section Velocity:, 1.73
Section Width:, 156.00
Section Area:, 236.94
Section Q:, 408.77
Section Diff:, 48.77
Section Pct Err:, 13.5%
Section Quality:, na
Section WetPerim:, 156.22
Section Hyd Rad:, 1.52
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT,	DIST,	TDPTH,	IDRFT,	EDPTH,	OBS,	TIME,	REVS,	HA,	HC:VF,	METH,	CLOCK,	MVEL,	OVEL,	VVEL,	SSAREA,	SSQ,	SSPCT,	FLAGS
1,	11.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	,00:00,	,	,	0.00,	0.00,	0.00,	0.0%,	
2,	35.00,	1.44,	0.00,	1.44,	o6,41.19,	33,	0,	1.00,	1.00,	14:33,	1.78,	1.78,	1.78,	20.88,	37.25,	9.1%,		
3,	40.00,	1.88,	0.00,	1.88,	o6,40.17,	44,	0,	1.00,	1.00,	14:37,	2.43,	2.43,	2.43,	9.40,	22.87,	5.6%,		
4,	45.00,	2.80,	0.00,	2.80,	o6,40.65,	47,	0,	1.00,	1.00,	14:40,	2.57,	2.57,	2.57,	12.60,	32.34,	7.9%,		
5,	49.00,	2.70,	0.00,	2.70,	o2,40.41,	45,	0,	1.00,	1.00,	14:45,	2.47,	2.47						
5,	49.00,	2.70,	0.00,	2.70,	o8,40.52,	40,	0,	1.00,	1.00,	14:43,	2.19,	2.19,	2.33,	10.80,	25.20,	6.2%,		
6,	53.00,	2.90,	0.00,	2.90,	o2,40.72,	42,	0,	1.00,	1.00,	14:47,	2.29,	2.29						
6,	53.00,	2.90,	0.00,	2.90,	o8,40.59,	41,	0,	1.00,	1.00,	14:49,	2.24,	2.24,	2.27,	11.60,	26.31,	6.4%,		
7,	57.00,	2.80,	0.00,	2.80,	o2,40.16,	41,	0,	1.00,	1.00,	14:52,	2.27,	2.27						
7,	57.00,	2.80,	0.00,	2.80,	o8,41.12,	38,	0,	1.00,	1.00,	14:51,	2.06,	2.06,	2.16,	11.20,	24.21,	5.9%,		
8,	61.00,	2.70,	0.00,	2.70,	o2,40.62,	41,	0,	1.00,	1.00,	14:54,	2.24,	2.24						
8,	61.00,	2.70,	0.00,	2.70,	o8,40.25,	36,	0,	1.00,	1.00,	14:55,	1.99,	1.99,	2.12,	10.80,	22.86,	5.6%,		
9,	65.00,	2.75,	0.00,	2.75,	o2,40.33,	44,	0,	1.00,	1.00,	14:58,	2.42,	2.42						
9,	65.00,	2.75,	0.00,	2.75,	o8,41.05,	40,	0,	1.00,	1.00,	14:57,	2.17,	2.17,	2.29,	11.00,	25.24,	6.2%,		
10,	69.00,	2.80,	0.00,	2.80,	o2,40.13,	44,	0,	1.00,	1.00,	15:00,	2.44,	2.44						
10,	69.00,	2.80,	0.00,	2.80,	o8,41.05,	42,	0,	1.00,	1.00,	15:01,	2.27,	2.27,	2.35,	11.20,	26.37,	6.5%,		
11,	73.00,	2.80,	0.00,	2.80,	o2,40.03,	41,	0,	1.00,	1.00,	15:04,	2.28,	2.28						
11,	73.00,	2.80,	0.00,	2.80,	o8,40.94,	37,16,	0.96,	1.00,	15:03,	2.01,	1.93,	2.10,	11.20,	23.55,	5.8%,			
12,	77.00,	2.49,	0.00,	2.49,	o6,40.31,	40,	0,	1.00,	1.00,	15:06,	2.21,	2.21,	2.21,	9.96,	21.97,	5.4%,		
13,	81.00,	2.40,	0.00,	2.40,	o6,40.61,	36,16,	0.96,	1.00,	15:11,	1.97,	1.89,	1.89,	9.60,	18.18,	4.4%,			
14,	85.00,	2.40,	0.00,	2.40,	o6,40.07,	33,23,	0.92,	1.00,	15:13,	1.83,	1.69,	1.69,	10.80,	18.22,	4.5%,			
15,	90.00,	2.05,	0.00,	2.05,	o6,41.26,	29,23,	0.92,	1.00,	15:15,	1.57,	1.44,	1.44,	10.25,	14.78,	3.6%,			
16,	95.00,	1.97,	0.00,	1.97,	o6,40.49,	24,16,	0.96,	1.00,	15:16,	1.32,	1.27,	1.27,	10.83,	13.78,	3.4%,			
17,	101.00,	1.73,	0.00,	1.73,	o6,40.07,	16,16,	0.96,	1.00,	15:18,	0.90,	0.86,	0.86,	11.25,	9.70,	2.4%,			

```
18,   108.00, 1.44, 0.00, 1.44, o6,40.20,  17,16, 0.96,1.00,15:20, 0.95, 0.91, 0.91,    10.08,     9.19,  2.2%,
19,   115.00, 1.22, 0.00, 1.22, o6,40.41,  20, 0, 1.00,1.00,15:22, 1.11, 1.11, 1.11,    10.37,    11.50,  2.8%,
20,   125.00, 1.10, 0.00, 1.10, o6,40.93,  23,14, 0.97,1.00,15:24, 1.26, 1.22, 1.22,    11.00,    13.41,  3.3%,
21,   135.00, 0.82, 0.00, 0.82, o6,42.38,  17,14, 0.97,1.00,15:26, 0.90, 0.88, 0.88,     8.20,     7.18,  1.8%,
22,   145.00, 0.82, 0.00, 0.82,  ,    ,    , ,    ,    ,15:26,    ,    , 0.00,     8.20,     0.00,  0.0%,
23,   155.00, 0.52, 0.00, 0.52, o6,42.90,  16,14, 0.97,1.00,15:27, 0.84, 0.81, 0.81,     5.72,     4.66,  1.1%,
24,   167.00, 0.00, 0.00, 0.00,  E,    ,    , ,    ,    ,15:28,    ,    , 0.00,     0.00,     0.00,  0.0%,

→
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AquaCalc Pro 2002

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,000000C2949C
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, 03262700
User ID:, MCD 2
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 06/07/05 09:07
End Time:, 06/07/05 10:10
Meas Time:, 1.05
Section Diff:, -6.21
Beg Gage height:, 2.50
End Gage height:, 0.00
Beg Staff height:, 2.52
End Staff height:, 0.00
Estimated Q:, 258.00
Adjusted Q:, 258.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 26
Section Velocity:, 0.69
Section Width:, 127.00
Section Area:, 362.87
Section Q:, 251.79
Section Diff:, -6.21
Section Pct Err:, -2.4%
Section Quality:, na
Section WetPerim:, 127.42
Section Hyd Rad:, 2.85
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT,	DIST,	TDPTH,	IDRFT,	EDPTH,	OBS,	TIME,	REVS,	HA,	HC:VF,	METH,	CLOCK,	MVEL,	OVEL,	VVEL,	SSAREA,	SSQ,	SSPCT,	FLAGS
1,	3.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	09:07,	,	,	0.00,	0.00,	0.00,	0.0%,	
2,	8.00,	1.62,	0.00,	1.62,	o6,	42.51,	6,	0,	1.00,	1.00,	09:09,	0.33,	0.33,	0.33,	8.91,	2.93,	1.2%,	
3,	14.00,	2.30,	0.00,	2.30,	o6,	41.18,	5,	0,	1.00,	1.00,	09:11,	0.29,	0.29,	0.29,	18.40,	5.25,	2.1%,	
4,	24.00,	2.75,	0.00,	2.75,	o2,	41.78,	11,	0,	1.00,	1.00,	09:15,	0.60,	0.60					
4,	24.00,	2.75,	0.00,	2.75,	o8,	43.78,	11,	0,	1.00,	1.00,	09:14,	0.57,	0.57,	0.59,	22.00,	12.87,	5.1%,	
5,	30.00,	3.05,	0.00,	3.05,	o2,	42.13,	12,	0,	1.00,	1.00,	09:16,	0.65,	0.65					
5,	30.00,	3.05,	0.00,	3.05,	o8,	40.94,	10,	0,	1.00,	1.00,	09:17,	0.56,	0.56,	0.60,	16.78,	10.08,	4.0%,	
6,	35.00,	3.00,	0.00,	3.00,	o2,	40.02,	14,	0,	1.00,	1.00,	09:21,	0.79,	0.79					
6,	35.00,	3.00,	0.00,	3.00,	o8,	40.87,	13,	0,	1.00,	1.00,	09:20,	0.72,	0.72,	0.75,	15.00,	11.31,	4.5%,	
7,	40.00,	3.40,	0.00,	3.40,	o2,	40.72,	16,	0,	1.00,	1.00,	09:22,	0.88,	0.88					
7,	40.00,	3.40,	0.00,	3.40,	o8,	44.91,	10,	0,	1.00,	1.00,	09:23,	0.51,	0.51,	0.70,	17.00,	11.84,	4.7%,	
8,	45.00,	3.30,	0.00,	3.30,	o2,	40.28,	18,	0,	1.00,	1.00,	09:26,	1.00,	1.00					
8,	45.00,	3.30,	0.00,	3.30,	o8,	42.31,	12,	0,	1.00,	1.00,	09:25,	0.64,	0.64,	0.82,	13.20,	10.86,	4.3%,	
9,	48.00,	3.60,	0.00,	3.60,	o2,	42.15,	17,	0,	1.00,	1.00,	09:28,	0.91,	0.91					
9,	48.00,	3.60,	0.00,	3.60,	o8,	40.34,	12,	0,	1.00,	1.00,	09:29,	0.67,	0.67,	0.79,	12.60,	9.96,	4.0%,	
10,	52.00,	3.40,	0.00,	3.40,	o2,	40.99,	17,	0,	1.00,	1.00,	09:31,	0.93,	0.93					
10,	52.00,	3.40,	0.00,	3.40,	o8,	40.20,	13,	0,	1.00,	1.00,	09:30,	0.73,	0.73,	0.83,	15.30,	12.72,	5.1%,	
11,	57.00,	3.20,	0.00,	3.20,	o2,	40.78,	18,	0,	1.00,	1.00,	09:33,	0.99,	0.99					
11,	57.00,	3.20,	0.00,	3.20,	o8,	40.59,	14,	0,	1.00,	1.00,	09:34,	0.78,	0.78,	0.88,	14.40,	12.74,	5.1%,	
12,	61.00,	2.90,	0.00,	2.90,	o2,	40.86,	20,	0,	1.00,	1.00,	09:37,	1.10,	1.10					
12,	61.00,	2.90,	0.00,	2.90,	o8,	42.65,	12,	0,	1.00,	1.00,	09:35,	0.64,	0.64,	0.87,	13.05,	11.32,	4.5%,	

```
13,    66.00, 3.10, 0.00, 3.10, o2,40.53,  17, 0, 1.00,1.00,09:38, 0.94, 0.94
13,    66.00, 3.10, 0.00, 3.10, o8,42.09,  14, 0, 1.00,1.00,09:39, 0.75, 0.75, 0.85,    13.95,    11.81,  4.7%,
14,    70.00, 3.20, 0.00, 3.20, o2,40.09,  17, 0, 1.00,1.00,09:42, 0.95, 0.95
14,    70.00, 3.20, 0.00, 3.20, o8,41.51,  13, 0, 1.00,1.00,09:41, 0.71, 0.71, 0.83,    14.40,    11.96,  4.7%,
15,    75.00, 3.05, 0.00, 3.05, o2,40.32,  18, 0, 1.00,1.00,09:43, 1.00, 1.00
15,    75.00, 3.05, 0.00, 3.05, o8,41.48,  15, 0, 1.00,1.00,09:44, 0.82, 0.82, 0.91,    13.72,    12.47,  5.0%,
16,    79.00, 3.10, 0.00, 3.10, o2,40.19,  18, 0, 1.00,1.00,09:46, 1.01, 1.01
16,    79.00, 3.10, 0.00, 3.10, o8,41.90,  13, 0, 1.00,1.00,09:46, 0.70, 0.70, 0.85,    13.95,    11.91,  4.7%,
17,    84.00, 3.00, 0.00, 3.00, o2,41.11,  18, 0, 1.00,1.00,09:48, 0.98, 0.98
17,    84.00, 3.00, 0.00, 3.00, o8,43.92,  11, 0, 1.00,1.00,09:49, 0.57, 0.57, 0.78,    15.00,    11.65,  4.6%,
18,    89.00, 3.00, 0.00, 3.00, o2,40.47,  15, 0, 1.00,1.00,09:51, 0.83, 0.83
18,    89.00, 3.00, 0.00, 3.00, o8,41.50,  11, 0, 1.00,1.00,09:50, 0.60, 0.60, 0.72,    16.50,    11.86,  4.7%,
19,    95.00, 3.10, 0.00, 3.10, o2,40.64,  16, 0, 1.00,1.00,09:53, 0.89, 0.89
19,    95.00, 3.10, 0.00, 3.10, o8,40.07,  11, 0, 1.00,1.00,09:54, 0.62, 0.62, 0.75,    17.05,    12.86,  5.1%,
20,   100.00, 3.25, 0.00, 3.25, o2,41.56,  16, 0, 1.00,1.00,09:57, 0.87, 0.87
20,   100.00, 3.25, 0.00, 3.25, o8,42.76,  12, 0, 1.00,1.00,09:56, 0.64, 0.64, 0.75,    16.25,    12.21,  4.8%,
21,   105.00, 3.30, 0.00, 3.30, o2,41.21,  14, 0, 1.00,1.00,09:58, 0.77, 0.77
21,   105.00, 3.30, 0.00, 3.30, o8,42.65,  10, 0, 1.00,1.00,09:59, 0.53, 0.53, 0.65,    18.15,    11.81,  4.7%,
22,   111.00, 3.15, 0.00, 3.15, o2,42.35,  15, 0, 1.00,1.00,10:02, 0.80, 0.80
22,   111.00, 3.15, 0.00, 3.15, o8,41.38,   9, 0, 1.00,1.00,10:01, 0.50, 0.50, 0.65,    18.90,    12.25,  4.9%,
23,   117.00, 2.50, 0.00, 2.50, o2,41.34,  13, 0, 1.00,1.00,10:04, 0.71, 0.71
23,   117.00, 2.50, 0.00, 2.50, o8,41.09,   5, 0, 1.00,1.00,10:05, 0.29, 0.29, 0.50,    15.00,     7.48,  3.0%,
24,   123.00, 2.26, 0.00, 2.26, o6,44.10,  10, 0, 1.00,1.00,10:07, 0.52, 0.52, 0.52,    13.56,     7.02,  2.8%,
25,   129.00, 2.45, 0.00, 2.45, o6,42.01,   9, 0, 1.00,1.00,10:09, 0.49, 0.49, 0.49,     8.57,     4.20,  1.7%,
26,   130.00, 2.45, 0.00, 2.45, EW,     ,    ,  , 0.70,1.00,10:09,     ,     , 0.34,     1.23,     0.42,  0.2%,

→
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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, 03262700
User ID:, MCD 1
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 08/02/05 08:57
End Time:, 08/02/05 09:35
Meas Time:, 0.63
Section Diff:, 144.92
Beg Gage height:, 2.22
End Gage height:, 0.00
Beg Staff height:, 2.23
End Staff height:, 0.00
Estimated Q:, 0.00
Adjusted Q:, 0.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 27
Section Velocity:, 2.22
Section Width:, 68.00
Section Area:, 65.39
Section Q:, 144.92
Section Diff:, 144.92
Section Pct Err:, 0.0%
Section Quality:, na
Section WetPerim:, 68.18
Section Hyd Rad:, 0.96
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT,	DIST,	TDPTH,	IDRFT,	EDPTH,	OBS,	TIME,	REVS,	HA,	HC:VF,	METH,	CLOCK,	MVEL,	OVEL,	VVEL,	SSAREA,	SSQ,	SSPCT,	FLAGS
1,	0.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	08:57,	,	,	0.00,	0.00,	0.00,	0.0%,	
2,	5.00,	0.30,	0.00,	0.30,	o6,40.09,	10,	0,	1.00,	1.00,	08:58,	0.57,	0.57,	0.57,	1.35,	0.77,	0.5%,		
3,	9.00,	0.38,	0.00,	0.38,	o6,41.53,	14,	14,	0.97,	1.00,	09:00,	0.76,	0.74,	0.74,	1.52,	1.12,	0.8%,		
4,	13.00,	1.00,	0.00,	1.00,	o6,41.59,	21,	14,	0.97,	1.00,	09:01,	1.13,	1.10,	1.10,	3.50,	3.84,	2.6%,		
5,	16.00,	1.22,	0.00,	1.22,	o6,41.03,	33,	8,	0.99,	1.00,	09:03,	1.79,	1.77,	1.77,	3.66,	6.49,	4.5%,		
6,	19.00,	1.45,	0.00,	1.45,	o6,40.24,	35,	0,	1.00,	1.00,	09:07,	1.94,	1.94,	1.94,	3.62,	7.02,	4.8%,		
7,	21.00,	1.42,	0.00,	1.42,	o6,40.97,	43,	0,	1.00,	1.00,	09:08,	2.33,	2.33,	2.33,	2.84,	6.62,	4.6%,		
8,	23.00,	1.44,	0.00,	1.44,	o6,40.51,	51,	0,	1.00,	1.00,	09:09,	2.79,	2.79,	2.79,	2.88,	8.05,	5.6%,		
9,	25.00,	1.44,	0.00,	1.44,	o6,40.72,	52,	0,	1.00,	1.00,	09:10,	2.83,	2.83,	2.83,	2.88,	8.16,	5.6%,		
10,	27.00,	1.42,	0.00,	1.42,	o6,40.49,	53,	0,	1.00,	1.00,	09:11,	2.90,	2.90,	2.90,	2.84,	8.25,	5.7%,		
11,	29.00,	1.52,	0.00,	1.52,	o6,40.20,	57,	0,	1.00,	1.00,	09:12,	3.14,	3.14,	3.14,	2.66,	8.36,	5.8%,		
12,	30.50,	1.54,	0.00,	1.54,	o6,40.41,	60,	0,	1.00,	1.00,	09:14,	3.29,	3.29,	3.29,	2.31,	7.60,	5.2%,		
13,	32.00,	1.58,	0.00,	1.58,	o6,40.84,	52,	0,	1.00,	1.00,	09:15,	2.83,	2.83,	2.83,	2.37,	6.70,	4.6%,		
14,	33.50,	1.60,	0.00,	1.60,	o6,40.24,	57,	0,	1.00,	1.00,	09:16,	3.14,	3.14,	3.14,	2.40,	7.54,	5.2%,		
15,	35.00,	1.54,	0.00,	1.54,	o6,40.47,	55,	0,	1.00,	1.00,	09:17,	3.01,	3.01,	3.01,	2.31,	6.96,	4.8%,		
16,	36.50,	1.54,	0.00,	1.54,	o6,40.46,	59,	0,	1.00,	1.00,	09:19,	3.23,	3.23,	3.23,	2.31,	7.47,	5.2%,		
17,	38.00,	1.44,	0.00,	1.44,	o6,40.53,	61,	0,	1.00,	1.00,	09:20,	3.34,	3.34,	3.34,	2.16,	7.21,	5.0%,		
18,	39.50,	1.34,	0.00,	1.34,	o6,40.15,	47,	0,	1.00,	1.00,	09:21,	2.60,	2.60,	2.60,	2.01,	5.22,	3.6%,		
19,	41.00,	1.56,	0.00,	1.56,	o6,40.86,	47,	0,	1.00,	1.00,	09:22,	2.55,	2.55,	2.55,	2.73,	6.97,	4.8%,		
20,	43.00,	1.52,	0.00,	1.52,	o6,40.39,	47,	0,	1.00,	1.00,	09:25,	2.58,	2.58,	2.58,	3.04,	7.85,	5.4%,		
21,	45.00,	1.52,	0.00,	1.52,	o6,40.49,	31,	0,	1.00,	1.00,	09:26,	1.71,	1.71,	1.71,	3.04,	5.19,	3.6%,		
22,	47.00,	1.38,	0.00,	1.38,	o6,40.78,	45,	0,	1.00,	1.00,	09:27,	2.45,	2.45,	2.45,	3.45,	8.46,	5.8%,		
23,	50.00,	1.02,	0.00,	1.02,	o6,40.89,	30,	0,	1.00,	1.00,	09:29,	1.64,	1.64,	1.64,	3.06,	5.00,	3.5%,		
24,	53.00,	0.56,	0.00,	0.56,	o6,40.62,	19,	8,	0.99,	1.00,	09:30,	1.05,	1.04,	1.04,	2.24,	2.33,	1.6%,		

```
25,    58.00, 0.50, 0.00, 0.50, o6,43.13,   8,16, 0.96,1.00,09:32, 0.43, 0.41, 0.41,     2.50,     1.02,  0.7%,
26,    63.00, 0.34, 0.00, 0.34, o6,43.17,  10,37, 0.80,1.00,09:35, 0.53, 0.42, 0.42,     1.70,     0.72,  0.5%,
27,    68.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,09:35,     ,     , 0.00,     0.00,     0.00,  0.0%,
```

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,000000C2949C
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, 03262700
User ID:, MCD 2
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 10/07/05 10:11
End Time:, 10/07/05 11:11
Meas Time:, 1.00
Section Diff:, 4.84
Beg Gage height:, 2.59
End Gage height:, 2.57
Beg Staff height:, 2.59
End Staff height:, 2.56
Estimated Q:, 323.00
Adjusted Q:, 328.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 26
Section Velocity:, 1.89
Section Width:, 137.00
Section Area:, 173.22
Section Q:, 327.84
Section Diff:, 4.84
Section Pct Err:, 1.5%
Section Quality:, na
Section WetPerim:, 137.13
Section Hyd Rad:, 1.26
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT	DIST	TDPTH	IDRFT	EDPTH	OBS	TIME	REVS	HA	HC:VF	METH	CLOCK	MVEL	OVEL	VVEL	SSAREA	SSQ	SSPCT	FLAGS
1	54.00	0.00	0.00	0.00	E	,	,	,	,	,	10:11	,	,	0.00	0.00	0.00	0.0%	
2	59.00	0.50	0.00	0.50	o6	42.34	15	0	1.00	1.00	10:12	0.80	0.80	0.80	2.50	2.00	0.6%	
3	64.00	0.62	0.00	0.62	o6	40.31	24	0	1.00	1.00	10:14	1.33	1.33	1.33	3.41	4.54	1.4%	
4	70.00	0.70	0.00	0.70	o6	41.54	30	0	1.00	1.00	10:16	1.61	1.61	1.61	4.20	6.76	2.1%	
5	76.00	1.27	0.00	1.27	o6	40.58	42	8	0.99	1.00	10:18	2.30	2.28	2.28	6.35	14.46	4.4%	
6	80.00	1.61	0.00	1.61	o6	40.14	46	8	0.99	1.00	10:28	2.54	2.52	2.52	5.64	14.19	4.3%	
7	83.00	1.90	0.00	1.90	o6	40.08	49	11	0.98	1.00	10:30	2.71	2.66	2.66	5.70	15.16	4.6%	
8	86.00	2.10	0.00	2.10	o6	40.76	46	8	0.99	1.00	10:32	2.51	2.48	2.48	6.30	15.63	4.8%	
9	89.00	2.12	0.00	2.12	o6	40.39	47	11	0.98	1.00	10:34	2.58	2.53	2.53	6.36	16.10	4.9%	
10	92.00	2.18	0.00	2.18	o6	40.78	47	11	0.98	1.00	10:36	2.56	2.51	2.51	6.54	16.40	5.0%	
11	95.00	2.12	0.00	2.12	o6	40.91	47	16	0.96	1.00	10:39	2.55	2.45	2.45	6.36	15.57	4.7%	
12	98.00	2.22	0.00	2.22	o6	40.81	47	16	0.96	1.00	10:40	2.56	2.45	2.45	6.66	16.35	5.0%	
13	101.00	2.23	0.00	2.23	o6	40.11	48	26	0.90	1.00	10:43	2.66	2.39	2.39	6.69	15.99	4.9%	
14	104.00	2.25	0.00	2.25	o6	40.29	45	23	0.92	1.00	10:45	2.48	2.28	2.28	6.75	15.40	4.7%	
15	107.00	2.18	0.00	2.18	o6	40.04	44	20	0.94	1.00	10:47	2.44	2.29	2.29	7.63	17.50	5.3%	
16	111.00	2.12	0.00	2.12	o6	40.02	42	20	0.94	1.00	10:49	2.33	2.19	2.19	8.48	18.59	5.7%	
17	115.00	1.97	0.00	1.97	o6	40.38	41	26	0.90	1.00	10:51	2.26	2.03	2.03	7.88	16.00	4.9%	
18	119.00	1.94	0.00	1.94	o6	40.12	40	37	0.80	1.00	10:53	2.22	1.77	1.77	9.70	17.20	5.2%	
19	125.00	1.67	0.00	1.67	o6	40.07	39	37	0.80	1.00	10:56	2.16	1.73	1.73	10.02	17.34	5.3%	
20	131.00	1.66	0.00	1.66	o6	40.80	35	37	0.80	1.00	10:58	1.91	1.53	1.53	9.96	15.21	4.6%	
21	137.00	1.46	0.00	1.46	o6	40.39	31	37	0.80	1.00	11:01	1.71	1.37	1.37	10.22	13.98	4.3%	
22	145.00	1.20	0.00	1.20	o6	40.87	26	23	0.92	1.00	11:03	1.42	1.31	1.31	10.80	14.11	4.3%	
23	155.00	1.00	0.00	1.00	o6	41.09	26	8	0.99	1.00	11:06	1.41	1.40	1.40	10.00	13.99	4.3%	
24	165.00	0.79	0.00	0.79	o6	40.58	25	8	0.99	1.00	11:08	1.38	1.36	1.36	9.88	13.45	4.1%	

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25,   180.00, 0.40, 0.00, 0.40, o6,43.43,   7, 8, 0.99,1.00,11:10, 0.37, 0.37, 0.37,     5.20,     1.92,  0.6%,
26,   191.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,11:11,     ,     , 0.00,     0.00,     0.00,  0.0%,

→
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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,000000C2949C
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR051205
User ID:, MCD 2
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 12/05/05 11:40
End Time:, 12/05/05 12:26
Meas Time:, 0.77
Section Diff:, 42.78
Beg Gage height:, 3.26
End Gage height:, 3.26
Beg Staff height:, 3.25
End Staff height:, 3.25
Estimated Q:, 760.00
Adjusted Q:, 803.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 32
Section Velocity:, 3.08
Section Width:, 196.00
Section Area:, 260.38
Section Q:, 802.78
Section Diff:, 42.78
Section Pct Err:, 5.6%
Section Quality:, na
Section WetPerim:, 196.27
Section Hyd Rad:, 1.33
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT,	DIST,	TDPTH,	IDRFT,	EDPTH,	OBS,	TIME,	REVS,	HA,	HC:VF,	METH,	CLOCK,	MVEL,	OVEL,	VVEL,	SSAREA,	SSQ,	SSPCT,	FLAGS
1,	18.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	11:40,	,	,	0.00,	0.00,	0.00,	0.0%,	
2,	22.00,	0.35,	0.00,	0.35,	o6,	41.34,	30,	0,	1.00,	1.00,	11:41,	1.62,	1.62,	1.62,	2.45,	3.96,	0.5%,	
3,	32.00,	0.85,	0.00,	0.85,	o6,	40.75,	36,	0,	1.00,	1.00,	11:43,	1.97,	1.97,	1.97,	7.65,	15.04,	1.9%,	
4,	40.00,	1.24,	0.00,	1.24,	o6,	40.54,	52,	0,	1.00,	1.00,	11:45,	2.85,	2.85,	2.85,	9.30,	26.47,	3.3%,	
5,	47.00,	1.30,	0.00,	1.30,	o6,	40.15,	60,	0,	1.00,	1.00,	11:47,	3.31,	3.31,	3.31,	9.10,	30.15,	3.8%,	
6,	54.00,	1.46,	0.00,	1.46,	o6,	40.08,	53,	0,	1.00,	1.00,	11:48,	2.93,	2.93,	2.93,	9.49,	27.84,	3.5%,	
7,	60.00,	1.92,	0.00,	1.92,	o6,	40.42,	69,	0,	1.00,	1.00,	11:49,	3.78,	3.78,	3.78,	9.60,	36.30,	4.5%,	
8,	64.00,	2.20,	0.00,	2.20,	o6,	40.18,	67,	0,	1.00,	1.00,	11:51,	3.69,	3.69,	3.69,	8.80,	32.51,	4.0%,	
9,	68.00,	2.33,	0.00,	2.33,	o6,	40.32,	69,	8,	0.99,	1.00,	11:53,	3.79,	3.75,	3.75,	9.32,	34.98,	4.4%,	
10,	72.00,	2.30,	0.00,	2.30,	o6,	40.03,	68,	8,	0.99,	1.00,	11:54,	3.76,	3.73,	3.73,	9.20,	34.27,	4.3%,	
11,	76.00,	2.46,	0.00,	2.46,	o6,	40.17,	67,	8,	0.99,	1.00,	11:55,	3.70,	3.66,	3.66,	9.84,	36.00,	4.5%,	
12,	80.00,	2.47,	0.00,	2.47,	o6,	40.38,	73,	8,	0.99,	1.00,	11:57,	4.00,	3.96,	3.96,	9.88,	39.16,	4.9%,	
13,	84.00,	2.60,	0.00,	2.60,	o2,	40.29,	75,	11,	0.98,	1.00,	11:58,	4.12,	4.04					
13,	84.00,	2.60,	0.00,	2.60,	o8,	40.20,	59,	11,	0.98,	1.00,	11:59,	3.25,	3.19,	3.61,	10.40,	37.59,	4.7%,	
14,	88.00,	2.55,	0.00,	2.55,	o2,	40.51,	73,	11,	0.98,	1.00,	12:02,	3.99,	3.91					
14,	88.00,	2.55,	0.00,	2.55,	o8,	40.58,	63,	11,	0.98,	1.00,	12:01,	3.44,	3.37,	3.64,	10.20,	37.14,	4.6%,	
15,	92.00,	2.55,	0.00,	2.55,	o2,	40.40,	72,	11,	0.98,	1.00,	12:04,	3.95,	3.87					
15,	92.00,	2.55,	0.00,	2.55,	o8,	40.62,	61,	11,	0.98,	1.00,	12:05,	3.33,	3.26,	3.57,	10.20,	36.37,	4.5%,	
16,	96.00,	2.48,	0.00,	2.48,	o6,	40.33,	68,	11,	0.98,	1.00,	12:06,	3.74,	3.66,	3.66,	9.92,	36.31,	4.5%,	
17,	100.00,	2.20,	0.00,	2.20,	o6,	40.36,	65,	11,	0.98,	1.00,	12:07,	3.57,	3.50,	3.50,	9.90,	34.62,	4.3%,	
18,	105.00,	2.14,	0.00,	2.14,	o6,	40.65,	61,	14,	0.97,	1.00,	12:09,	3.33,	3.23,	3.23,	10.70,	34.52,	4.3%,	
19,	110.00,	2.14,	0.00,	2.14,	o6,	40.08,	57,	14,	0.97,	1.00,	12:10,	3.15,	3.06,	3.06,	11.77,	36.00,	4.5%,	
20,	116.00,	2.03,	0.00,	2.03,	o6,	40.53,	52,	14,	0.97,	1.00,	12:11,	2.85,	2.76,	2.76,	14.21,	39.24,	4.9%,	
21,	124.00,	1.84,	0.00,	1.84,	o6,	40.68,	56,	11,	0.98,	1.00,	12:13,	3.05,	2.99,	2.99,	12.88,	38.54,	4.8%,	

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22,   130.00, 1.90, 0.00, 1.90, o6,40.67,  55, 0, 1.00,1.00,12:14, 3.00, 3.00, 3.00,    12.35,    37.04,  4.6%,
23,   137.00, 1.60, 0.00, 1.60, o6,40.18,  58, 0, 1.00,1.00,12:15, 3.20, 3.20, 3.20,    11.20,    35.84,  4.5%,
24,   144.00, 1.52, 0.00, 1.52, o6,40.02,  57, 0, 1.00,1.00,12:17, 3.16, 3.16, 3.16,    10.64,    33.60,  4.2%,
25,   151.00, 1.42, 0.00, 1.42, o6,40.69,  50, 0, 1.00,1.00,12:18, 2.73, 2.73, 2.73,    11.36,    30.98,  3.9%,
26,   160.00, 1.10, 0.00, 1.10, o6,41.46,  26, 0, 1.00,1.00,12:19, 1.40, 1.40, 1.40,     9.90,    13.86,  1.7%,
27,   169.00, 0.66, 0.00, 0.66, o6,43.72,   4, 0, 1.00,1.00,12:21, 0.22, 0.22, 0.22,     4.29,     0.94,  0.1%,
28,   173.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,12:21,     ,     , 0.00,     0.00,     0.00,  0.0%,
29,   200.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,12:23,     ,     , 0.00,     0.00,     0.00,  0.0%,
30,   204.00, 0.46, 0.00, 0.46, o6,40.58,  11, 0, 1.00,1.00,12:24, 0.62, 0.62, 0.62,     2.53,     1.56,  0.2%,
31,   211.00, 0.66, 0.00, 0.66, o6,42.23,  11, 0, 1.00,1.00,12:26, 0.59, 0.59, 0.59,     3.30,     1.95,  0.2%,
32,   214.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,12:26,     ,     , 0.00,     0.00,     0.00,  0.0%,
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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,000000C2949C
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:,            TR060209
User ID:,              MCD 2
Meter name:,           PAA11 std2
Meter id:,             0-00A
Meter type:,           PAA11
Meter Standard:,       SAE
Meter Revs/Pulses:,   1/1
Meter Const.S1:,      2.2048
Meter Const.O1:,      0.0178
Meter Const.C1:,      0.0000
Meter Const.S2:,      0.0000
Meter Const.O2:,      0.0000
Meter Const.C1:,      0.0000
Meter Const.S3:,      0.0000
Meter Const.O3:,      0.0000
Beg Time:,           02/09/06 13:36
End Time:,           02/09/06 15:17
Meas Time:,           1.68
Section Diff:,      120.39
Beg Gage height:,     3.84
End Gage height:,     3.80
Beg Staff height:,    3.84
End Staff height:,    3.80
Estimated Q:,      1130.00
Adjusted  Q:,      1250.00
Measure time:,       40
Measure standard:,     SAE
Measure equipment:,    Susp.Cable
Sounding Weight:,      C30  0.50
Measure ice:,          No
Flood Measurement:,    No
Flood Coef:,          0.00
Max Vertical Q:,      5%
Percent Slope:,       0.0000
Measure Start at:,     LEW No
Vertical Count:,     28
Section Velocity:,    0.64
Section Width:,     290.00
Section Area:,     1938.70
Section Q:,        1250.39
Section Diff:,      120.39
Section Pct Err:,    10.7%
Section Quality:,      na
Section WetPerim:,  292.28
Section Hyd Rad:,     6.63
Section Manning:,     0.0000
Section Chezy:,       0.0000

VERT,   DIST,TDPTH,IDRFT,EDPTH,OBS,  TIME,REVS,HA,HC:VF,METH,CLOCK, MVEL, OVEL, VVEL,   SSAREA,      SSQ,SSPCT,
FLAGS
 1,    94.00, 0.00, 0.00, 0.00,  E,      ,    ,  ,    ,     ,13:36,      ,      , 0.00,     0.00,     0.00,  0.0%,
 2,   110.00, 2.30, 0.00, 2.30, o6,42.37,   5, 0, 1.00,1.00,13:42, 0.28, 0.28, 0.28,    35.65,     9.91,  0.8%,
 3,   125.00, 3.30, 0.00, 3.30, o2,45.54,   6, 0, 1.00,1.00,13:46, 0.31, 0.31
 3,   125.00, 3.30, 0.00, 3.30, o8,44.33,   3, 0, 1.00,1.00,13:45, 0.17, 0.17, 0.24,    66.00,    15.68,  1.3%,
 4,   150.00, 6.00, 0.00, 6.00, o2,44.44,   5, 0, 1.00,1.00,13:52, 0.27, 0.27
 4,   150.00, 6.00, 0.00, 6.00, o8,42.44,   4, 0, 1.00,1.00,13:51, 0.23, 0.23, 0.25,   135.00,    33.17,  2.7%,
 5,   170.00, 7.80, 0.00, 7.80, o2,40.47,  12,26, 0.90,1.00,13:56, 0.67, 0.60
 5,   170.00, 7.80, 0.00, 7.80, o8,40.38,  10,26, 0.90,1.00,13:55, 0.56, 0.51, 0.56,   117.00,    65.04,  5.2%,
 6,   180.00, 7.80, 0.00, 7.80, o2,40.46,  11,26, 0.90,1.00,14:02, 0.62, 0.56
 6,   180.00, 7.80, 0.00, 7.80, o8,42.95,   9,26, 0.90,1.00,14:01, 0.48, 0.43, 0.49,    97.50,    48.13,  3.8%,
 7,   195.00, 7.60, 0.00, 7.60, o2,42.83,  15,18, 0.95,1.00,14:06, 0.79, 0.75
 7,   195.00, 7.60, 0.00, 7.60, o8,42.12,  11,18, 0.95,1.00,14:04, 0.59, 0.56, 0.66,   102.60,    67.43,  5.4%,
 8,   207.00, 7.00, 0.00, 7.00, o2,40.47,  15,20, 0.94,1.00,14:09, 0.83, 0.78
 8,   207.00, 7.00, 0.00, 7.00, o8,40.68,  13,20, 0.94,1.00,14:08, 0.72, 0.68, 0.73,    77.00,    56.36,  4.5%,
 9,   217.00, 7.20, 0.00, 7.20, o2,41.63,  15,16, 0.96,1.00,14:13, 0.81, 0.78
 9,   217.00, 7.20, 0.00, 7.20, o8,43.67,  13,16, 0.96,1.00,14:12, 0.67, 0.65, 0.71,    75.60,    53.94,  4.3%,
10,   228.00, 6.30, 0.00, 6.30, o2,41.06,  14,16, 0.96,1.00,14:16, 0.77, 0.74
10,   228.00, 6.30, 0.00, 6.30, o8,40.28,  10,16, 0.96,1.00,14:15, 0.57, 0.54, 0.64,    72.45,    46.42,  3.7%,
11,   240.00, 9.00, 0.00, 9.00, o2,40.99,  16,16, 0.96,1.00,14:19, 0.88, 0.84
11,   240.00, 9.00, 0.00, 9.00, o8,42.43,  12,16, 0.96,1.00,14:18, 0.64, 0.62, 0.73,    99.00,    72.22,  5.8%,
12,   250.00, 9.20, 0.00, 9.20, o2,41.61,  16,16, 0.96,1.00,14:23, 0.87, 0.83
12,   250.00, 9.20, 0.00, 9.20, o8,42.26,  14,16, 0.96,1.00,14:21, 0.75, 0.72, 0.77,    82.80,    64.14,  5.1%,
13,   258.00, 9.00, 0.00, 9.00, o2,41.37,  19,14, 0.97,1.00,14:26, 1.03, 1.00
13,   258.00, 9.00, 0.00, 9.00, o8,40.33,  14,14, 0.97,1.00,14:25, 0.78, 0.76, 0.88,    67.50,    59.37,  4.7%,
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14,   265.00, 8.80, 0.00, 8.80, o2,41.09,  19,16, 0.96,1.00,14:29, 1.04, 1.00
14,   265.00, 8.80, 0.00, 8.80, o8,40.78,  14,16, 0.96,1.00,14:28, 0.77, 0.74, 0.87,    61.60,    53.58,  4.3%,
15,   272.00, 8.70, 0.00, 8.70, o2,42.21,  19,16, 0.96,1.00,14:32, 1.01, 0.97
15,   272.00, 8.70, 0.00, 8.70, o8,41.70,  12,16, 0.96,1.00,14:31, 0.65, 0.63, 0.80,    65.25,    52.07,  4.2%,
16,   280.00, 8.10, 0.00, 8.10, o2,40.55,  18,11, 0.98,1.00,14:35, 1.00, 0.98
16,   280.00, 8.10, 0.00, 8.10, o8,42.85,  15,11, 0.98,1.00,14:34, 0.79, 0.77, 0.88,    64.80,    56.71,  4.5%,
17,   288.00, 8.00, 0.00, 8.00, o2,40.23,  19,11, 0.98,1.00,14:39, 1.06, 1.04
17,   288.00, 8.00, 0.00, 8.00, o8,41.42,  13,11, 0.98,1.00,14:37, 0.71, 0.70, 0.87,    64.00,    55.47,  4.4%,
18,   296.00, 8.00, 0.00, 8.00, o2,42.31,  19,11, 0.98,1.00,14:41, 1.01, 0.99
18,   296.00, 8.00, 0.00, 8.00, o8,42.44,  11,11, 0.98,1.00,14:40, 0.59, 0.58, 0.78,    64.00,    50.09,  4.0%,
19,   304.00, 8.50, 0.00, 8.50, o2,40.68,  16,11, 0.98,1.00,14:45, 0.88, 0.87
19,   304.00, 8.50, 0.00, 8.50, o8,41.89,  12,11, 0.98,1.00,14:44, 0.65, 0.64, 0.75,    72.25,    54.32,  4.3%,
20,   313.00, 8.10, 0.00, 8.10, o2,41.83,  12,11, 0.98,1.00,14:49, 0.65, 0.64
20,   313.00, 8.10, 0.00, 8.10, o8,40.62,  10,11, 0.98,1.00,14:48, 0.56, 0.55, 0.59,    76.95,    45.66,  3.7%,
21,   323.00, 9.70, 0.00, 9.70, o2,40.82,  15,11, 0.98,1.00,14:53, 0.83, 0.81
21,   323.00, 9.70, 0.00, 9.70, o8,42.25,  15,11, 0.98,1.00,14:52, 0.80, 0.78, 0.80,    82.45,    65.79,  5.3%,
22,   330.00, 9.60, 0.00, 9.60, o2,40.14,  15,11, 0.98,1.00,14:57, 0.84, 0.82
22,   330.00, 9.60, 0.00, 9.60, o8,40.57,  10,11, 0.98,1.00,14:56, 0.56, 0.55, 0.69,    72.00,    49.50,  4.0%,
23,   338.00, 7.70, 0.00, 7.70, o2,42.20,  15,11, 0.98,1.00,15:00, 0.80, 0.79
23,   338.00, 7.70, 0.00, 7.70, o8,42.04,  12,11, 0.98,1.00,14:59, 0.65, 0.63, 0.71,    61.60,    43.73,  3.5%,
24,   346.00, 7.30, 0.00, 7.30, o2,41.03,  12,14, 0.97,1.00,15:04, 0.66, 0.64
24,   346.00, 7.30, 0.00, 7.30, o8,42.85,  12,14, 0.97,1.00,15:03, 0.64, 0.62, 0.63,    58.40,    36.76,  2.9%,
25,   354.00, 7.20, 0.00, 7.20, o2,41.38,  13,14, 0.97,1.00,15:11, 0.71, 0.69
25,   354.00, 7.20, 0.00, 7.20, o8,42.69,   8,14, 0.97,1.00,15:09, 0.43, 0.42, 0.55,    68.40,    37.87,  3.0%,
26,   365.00, 6.40, 0.00, 6.40, o2,40.22,  12,14, 0.97,1.00,15:14, 0.68, 0.66
26,   365.00, 6.40, 0.00, 6.40, o8,41.48,  11,14, 0.97,1.00,15:13, 0.60, 0.58, 0.62,    70.40,    43.64,  3.5%,
27,   376.00, 3.00, 0.00, 3.00, o2,42.09,   9,14, 0.97,1.00,15:17, 0.49, 0.47
27,   376.00, 3.00, 0.00, 3.00, o8,42.99,   9,14, 0.97,1.00,15:16, 0.48, 0.46, 0.47,    28.50,    13.39,  1.1%,
28,   384.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,15:17,     ,     , 0.00,     0.00,     0.00,  0.0%,
```

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR060411
User ID:, MCD 1
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 04/11/06 12:22
End Time:, 04/11/06 13:25
Meas Time:, 1.05
Section Diff:, 645.93
Beg Gage height:, 3.07
End Gage height:, 0.00
Beg Staff height:, 3.09
End Staff height:, 0.00
Estimated Q:, 0.00
Adjusted Q:, 0.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 31
Section Velocity:, 2.20
Section Width:, 185.00
Section Area:, 293.03
Section Q:, 645.93
Section Diff:, 645.93
Section Pct Err:, 0.0%
Section Quality:, na
Section WetPerim:, 185.30
Section Hyd Rad:, 1.58
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT	DIST	TDPTH	IDRFT	EDPTH	OBS	TIME	REVS	HA	HC:VF	METH	CLOCK	MVEL	OVEL	VVEL	SSAREA	SSQ	SSPCT	FLAGS
1	9.00	0.00	0.00	0.00	E						12:22			0.00	0.00	0.00	0.0%	
2	15.00	0.43	0.00	0.43	o6	42.93	13,26	0.90	1.00	12:24	0.69	0.62	0.62	3.65	2.25	0.3%		
3	26.00	0.68	0.00	0.68	o6	40.11	33,26	0.90	1.00	12:26	1.83	1.65	1.65	6.46	10.65	1.6%		
4	34.00	1.18	0.00	1.18	o6	40.04	50,20	0.94	1.00	12:27	2.77	2.60	2.60	8.26	21.52	3.3%		
5	40.00	1.66	0.00	1.66	o6	40.26	56,23	0.92	1.00	12:29	3.08	2.84	2.84	9.13	25.91	4.0%		
6	45.00	2.35	0.00	2.35	o6	40.64	63,20	0.94	1.00	12:31	3.44	3.23	3.23	9.40	30.36	4.7%		
7	48.00	2.60	0.00	2.60	o2	40.38	66,20	0.94	1.00	12:34	3.62	3.40						
7	48.00	2.60	0.00	2.60	o8	40.54	51,20	0.94	1.00	12:33	2.79	2.62	3.01	7.80	23.51	3.6%		
8	51.00	3.05	0.00	3.05	o2	40.44	64,16	0.96	1.00	12:36	3.51	3.37						
8	51.00	3.05	0.00	3.05	o8	40.31	48,16	0.96	1.00	12:37	2.64	2.54	2.95	10.67	31.51	4.9%		
9	55.00	3.15	0.00	3.15	o2	40.10	65,16	0.96	1.00	12:41	3.59	3.45						
9	55.00	3.15	0.00	3.15	o8	40.06	54,16	0.96	1.00	12:40	2.99	2.87	3.16	11.02	34.83	5.4%		
10	58.00	3.15	0.00	3.15	o2	40.02	62,16	0.96	1.00	12:43	3.43	3.30						
10	58.00	3.15	0.00	3.15	o8	40.75	58,16	0.96	1.00	12:45	3.16	3.03	3.16	9.45	29.89	4.6%		
11	61.00	3.15	0.00	3.15	o2	40.15	62,16	0.96	1.00	12:47	3.42	3.29						
11	61.00	3.15	0.00	3.15	o8	40.72	55,16	0.96	1.00	12:46	3.00	2.88	3.08	9.45	29.11	4.5%		
12	64.00	3.10	0.00	3.10	o2	40.41	57,16	0.96	1.00	12:49	3.13	3.00						
12	64.00	3.10	0.00	3.10	o8	40.54	52,16	0.96	1.00	12:50	2.85	2.73	2.87	10.85	31.11	4.8%		
13	68.00	3.15	0.00	3.15	o2	40.32	56,16	0.96	1.00	12:52	3.08	2.96						
13	68.00	3.15	0.00	3.15	o8	40.41	50,16	0.96	1.00	12:51	2.75	2.64	2.80	12.60	35.23	5.5%		
14	72.00	3.15	0.00	3.15	o2	40.03	47,20	0.94	1.00	12:54	2.61	2.45						
14	72.00	3.15	0.00	3.15	o8	40.01	47,20	0.94	1.00	12:55	2.61	2.45	2.45	12.60	30.88	4.8%		
15	76.00	3.15	0.00	3.15	o2	40.77	45,20	0.94	1.00	12:58	2.45	2.30						
15	76.00	3.15	0.00	3.15	o8	40.64	43,20	0.94	1.00	12:57	2.35	2.21	2.26	14.17	31.99	5.0%		

```
16,    81.00, 3.05, 0.00, 3.05, o2,40.53,  37,20, 0.94,1.00,12:59, 2.03, 1.91
16,    81.00, 3.05, 0.00, 3.05, o8,40.20,  40,20, 0.94,1.00,13:01, 2.21, 2.08, 1.99,    16.78,    33.45,  5.2%,
17,    87.00, 2.85, 0.00, 2.85, o2,40.25,  35,23, 0.92,1.00,13:04, 1.94, 1.78
17,    87.00, 2.85, 0.00, 2.85, o8,40.76,  42,23, 0.92,1.00,13:03, 2.29, 2.11, 1.94,    17.10,    33.23,  5.1%,
18,    93.00, 2.60, 0.00, 2.60, o2,41.26,  31,26, 0.90,1.00,13:06, 1.67, 1.51
18,    93.00, 2.60, 0.00, 2.60, o8,41.02,  34,26, 0.90,1.00,13:07, 1.85, 1.66, 1.58,    16.90,    26.77,  4.1%,
19,   100.00, 2.33, 0.00, 2.33, o6,40.99,  30,26, 0.90,1.00,13:09, 1.63, 1.47, 1.47,    19.80,    29.08,  4.5%,
20,   110.00, 1.95, 0.00, 1.95, o6,40.86,  26,14, 0.97,1.00,13:11, 1.42, 1.38, 1.38,    19.50,    26.87,  4.2%,
21,   120.00, 1.80, 0.00, 1.80, o6,40.89,  34, 0, 1.00,1.00,13:12, 1.85, 1.85, 1.85,    16.20,    29.99,  4.6%,
22,   128.00, 1.53, 0.00, 1.53, o6,40.68,  40, 0, 1.00,1.00,13:13, 2.19, 2.19, 2.19,    12.24,    26.75,  4.1%,
23,   136.00, 1.40, 0.00, 1.40, o6,40.10,  45, 8, 0.99,1.00,13:15, 2.49, 2.47, 2.47,    11.20,    27.63,  4.3%,
24,   144.00, 1.16, 0.00, 1.16, o6,40.41,  43, 8, 0.99,1.00,13:16, 2.36, 2.34, 2.34,     9.86,    23.08,  3.6%,
25,   153.00, 0.90, 0.00, 0.90, o6,40.28,  36,11, 0.98,1.00,13:18, 1.99, 1.95, 1.95,     8.55,    16.66,  2.6%,
26,   163.00, 0.57, 0.00, 0.57, o6,40.68,  10, 0, 1.00,1.00,13:19, 0.56, 0.56, 0.56,     3.99,     2.23,  0.3%,
27,   167.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,13:20,     ,     , 0.00,     0.00,     0.00,  0.0%,
28,   180.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,13:21,     ,     , 0.00,     0.00,     0.00,  0.0%,
29,   185.00, 0.57, 0.00, 0.57, o6,41.14,   4, 0, 1.00,1.00,13:22, 0.23, 0.23, 0.23,     3.13,     0.73,  0.1%,
30,   191.00, 0.50, 0.00, 0.50, o6,44.62,   6, 0, 1.00,1.00,13:24, 0.31, 0.31, 0.31,     2.25,     0.71,  0.1%,
31,   194.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,13:25,     ,     , 0.00,     0.00,     0.00,  0.0%,
```

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR060807
User ID:, MCD 1
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 08/07/06 10:58
End Time:, 08/07/06 11:40
Meas Time:, 0.70
Section Diff:, 327.69
Beg Gage height:, 2.58
End Gage height:, 0.00
Beg Staff height:, 2.58
End Staff height:, 0.00
Estimated Q:, 0.00
Adjusted Q:, 0.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 28
Section Velocity:, 2.16
Section Width:, 134.00
Section Area:, 151.82
Section Q:, 327.69
Section Diff:, 327.69
Section Pct Err:, 0.0%
Section Quality:, na
Section WetPerim:, 134.12
Section Hyd Rad:, 1.13
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT,	DIST,	TDPTH,	IDRFT,	EDPTH,	OBS,	TIME,	REVS,	HA,	HC:VF,	METH,	CLOCK,	MVEL,	OVEL,	VVEL,	SSAREA,	SSQ,	SSPCT,	FLAGS
1,	14.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	10:58,	,	,	0.00,	0.00,	0.00,	0.0%,	
2,	18.00,	0.42,	0.00,	0.42,	o6,43.21,	7,	0,	1.00,	1.00,	11:00,	0.37,	0.37,	0.37,	2.94,	1.10,	0.3%,		
3,	28.00,	0.54,	0.00,	0.54,	o6,40.83,	32,	8,	0.99,	1.00,	11:01,	1.75,	1.73,	1.73,	5.13,	8.87,	2.7%,		
4,	37.00,	0.68,	0.00,	0.68,	o6,40.17,	37,	0,	1.00,	1.00,	11:03,	2.05,	2.05,	2.05,	5.10,	10.45,	3.2%,		
5,	43.00,	1.10,	0.00,	1.10,	o6,40.20,	41,	0,	1.00,	1.00,	11:04,	2.27,	2.27,	2.27,	6.05,	13.71,	4.2%,		
6,	48.00,	1.60,	0.00,	1.60,	o6,40.33,	41,	8,	0.99,	1.00,	11:06,	2.26,	2.24,	2.24,	7.20,	16.10,	4.9%,		
7,	52.00,	1.70,	0.00,	1.70,	o6,40.04,	43,	8,	0.99,	1.00,	11:07,	2.39,	2.36,	2.36,	5.95,	14.05,	4.3%,		
8,	55.00,	1.62,	0.00,	1.62,	o6,40.16,	45,	11,	0.98,	1.00,	11:09,	2.49,	2.44,	2.44,	5.67,	13.83,	4.2%,		
9,	59.00,	1.70,	0.00,	1.70,	o6,40.42,	48,	11,	0.98,	1.00,	11:10,	2.64,	2.58,	2.58,	5.95,	15.37,	4.7%,		
10,	62.00,	1.74,	0.00,	1.74,	o6,40.66,	49,	14,	0.97,	1.00,	11:12,	2.67,	2.59,	2.59,	5.22,	13.54,	4.1%,		
11,	65.00,	1.80,	0.00,	1.80,	o6,40.67,	49,	16,	0.96,	1.00,	11:13,	2.67,	2.57,	2.57,	5.40,	13.86,	4.2%,		
12,	68.00,	2.00,	0.00,	2.00,	o6,40.17,	48,	20,	0.94,	1.00,	11:15,	2.65,	2.49,	2.49,	6.00,	14.96,	4.6%,		
13,	71.00,	2.00,	0.00,	2.00,	o6,40.69,	48,	20,	0.94,	1.00,	11:16,	2.62,	2.46,	2.46,	6.00,	14.77,	4.5%,		
14,	74.00,	2.05,	0.00,	2.05,	o6,40.15,	48,	20,	0.94,	1.00,	11:17,	2.65,	2.49,	2.49,	6.15,	15.34,	4.7%,		
15,	77.00,	1.94,	0.00,	1.94,	o6,40.36,	46,	20,	0.94,	1.00,	11:18,	2.53,	2.38,	2.38,	5.82,	13.84,	4.2%,		
16,	80.00,	1.86,	0.00,	1.86,	o6,40.97,	45,	20,	0.94,	1.00,	11:20,	2.44,	2.29,	2.29,	6.51,	14.93,	4.6%,		
17,	84.00,	1.54,	0.00,	1.54,	o6,40.44,	45,	20,	0.94,	1.00,	11:22,	2.47,	2.32,	2.32,	6.16,	14.31,	4.4%,		
18,	88.00,	1.43,	0.00,	1.43,	o6,40.45,	46,	20,	0.94,	1.00,	11:23,	2.53,	2.37,	2.37,	5.72,	13.58,	4.1%,		
19,	92.00,	1.47,	0.00,	1.47,	o6,40.22,	44,	20,	0.94,	1.00,	11:24,	2.43,	2.28,	2.28,	5.88,	13.43,	4.1%,		
20,	96.00,	1.50,	0.00,	1.50,	o6,40.11,	40,	20,	0.94,	1.00,	11:26,	2.22,	2.08,	2.08,	6.75,	14.06,	4.3%,		
21,	101.00,	1.36,	0.00,	1.36,	o6,40.42,	41,	16,	0.96,	1.00,	11:27,	2.25,	2.16,	2.16,	6.80,	14.72,	4.5%,		
22,	106.00,	1.22,	0.00,	1.22,	o6,40.94,	40,	14,	0.97,	1.00,	11:29,	2.17,	2.11,	2.11,	6.71,	14.14,	4.3%,		
23,	112.00,	1.14,	0.00,	1.14,	o6,41.00,	38,	8,	0.99,	1.00,	11:31,	2.06,	2.04,	2.04,	6.84,	13.96,	4.3%,		
24,	118.00,	1.03,	0.00,	1.03,	o6,41.07,	36,	0,	1.00,	1.00,	11:33,	1.95,	1.95,	1.95,	6.69,	13.06,	4.0%,		

```
25,   125.00, 0.76, 0.00, 0.76, o6,40.26,  35, 0, 1.00,1.00,11:34, 1.93, 1.93, 1.93,     5.70,    11.03,  3.4%,
26,   133.00, 0.70, 0.00, 0.70, o6,41.35,  21, 8, 0.99,1.00,11:36, 1.14, 1.13, 1.13,     5.95,     6.70,  2.0%,
27,   142.00, 0.47, 0.00, 0.47, o6,41.19,  21, 8, 0.99,1.00,11:37, 1.14, 1.13, 1.13,     3.53,     3.98,  1.2%,
28,   148.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,11:40,     ,     , 0.00,     0.00,     0.00,  0.0%,

→
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AquaCalc Pro 2002

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR061013
User ID:, MCD 1
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 10/13/06 12:58
End Time:, 10/13/06 13:34
Meas Time:, 0.60
Section Diff:, -9.37
Beg Gage height:, 2.62
End Gage height:, 0.00
Beg Staff height:, 2.62
End Staff height:, 0.00
Estimated Q:, 340.00
Adjusted Q:, 340.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 25
Section Velocity:, 2.13
Section Width:, 132.00
Section Area:, 155.27
Section Q:, 330.63
Section Diff:, -9.37
Section Pct Err:, -2.8%
Section Quality:, na
Section WetPerim:, 132.12
Section Hyd Rad:, 1.18
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT	DIST	TDPTH	IDRFT	EDPTH	OBS	TIME	REVS	HA	HC:VF	METH	CLOCK	MVEL	OVEL	VVEL	SSAREA	SSQ	SSPCT	FLAGS
1	14.00	0.00	0.00	0.00	E	,	,	,	,	,	12:58	,	,	0.00	0.00	0.00	0.0%	
2	18.00	0.46	0.00	0.46	o6	41.21	19	0	1.00	1.00	13:00	1.03	1.03	1.03	3.68	3.81	1.2%	
3	30.00	0.57	0.00	0.57	o6	41.16	26	0	1.00	1.00	13:01	1.41	1.41	1.41	6.27	8.84	2.7%	
4	40.00	0.96	0.00	0.96	o6	40.94	43	0	1.00	1.00	13:02	2.33	2.33	2.33	7.20	16.80	5.1%	
5	45.00	1.38	0.00	1.38	o6	41.01	44	0	1.00	1.00	13:04	2.38	2.38	2.38	6.90	16.45	5.0%	
6	50.00	1.66	0.00	1.66	o6	40.31	46	8	0.99	1.00	13:05	2.53	2.51	2.51	6.64	16.66	5.0%	
7	53.00	1.64	0.00	1.64	o6	40.05	49	8	0.99	1.00	13:07	2.72	2.69	2.69	5.74	15.43	4.7%	
8	57.00	1.64	0.00	1.64	o6	40.04	49	11	0.98	1.00	13:08	2.72	2.66	2.66	5.74	15.28	4.6%	
9	60.00	1.83	0.00	1.83	o6	40.73	49	14	0.97	1.00	13:10	2.67	2.59	2.59	6.40	16.59	5.0%	
10	64.00	1.98	0.00	1.98	o6	40.20	47	20	0.94	1.00	13:12	2.60	2.44	2.44	6.93	16.91	5.1%	
11	67.00	2.10	0.00	2.10	o6	40.15	47	20	0.94	1.00	13:13	2.60	2.44	2.44	6.30	15.39	4.7%	
12	70.00	2.05	0.00	2.05	o6	40.53	48	16	0.96	1.00	13:14	2.63	2.52	2.52	6.15	15.52	4.7%	
13	73.00	2.00	0.00	2.00	o6	40.84	46	20	0.94	1.00	13:15	2.50	2.35	2.35	7.00	16.46	5.0%	
14	77.00	1.85	0.00	1.85	o6	40.13	44	23	0.92	1.00	13:17	2.44	2.24	2.24	7.40	16.58	5.0%	
15	81.00	1.53	0.00	1.53	o6	40.08	44	26	0.90	1.00	13:19	2.44	2.19	2.19	6.88	15.11	4.6%	
16	86.00	1.53	0.00	1.53	o6	40.97	43	26	0.90	1.00	13:21	2.33	2.10	2.10	7.65	16.05	4.9%	
17	91.00	1.50	0.00	1.50	o6	40.23	43	26	0.90	1.00	13:22	2.37	2.14	2.14	7.50	16.03	4.8%	
18	96.00	1.53	0.00	1.53	o6	40.31	40	26	0.90	1.00	13:23	2.21	1.99	1.99	7.65	15.19	4.6%	
19	101.00	1.37	0.00	1.37	o6	40.09	39	23	0.92	1.00	13:26	2.16	1.99	1.99	8.22	16.35	4.9%	
20	108.00	1.26	0.00	1.26	o6	40.86	37	8	0.99	1.00	13:28	2.01	1.99	1.99	8.19	16.33	4.9%	
21	114.00	1.10	0.00	1.10	o6	41.06	36	0	1.00	1.00	13:30	1.95	1.95	1.95	7.70	15.02	4.5%	

```
22,   122.00, 0.95, 0.00, 0.95, o6,40.86,  35, 0, 1.00,1.00,13:31, 1.91, 1.91, 1.91,     7.60,    14.49,  4.4%,
23,   130.00, 0.80, 0.00, 0.80, o6,41.07,  28, 0, 1.00,1.00,13:32, 1.52, 1.52, 1.52,     7.20,    10.95,  3.3%,
24,   140.00, 0.54, 0.00, 0.54, o6,41.49,  19, 8, 0.99,1.00,13:34, 1.03, 1.02, 1.02,     4.32,     4.39,  1.3%,
25,   146.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,13:34,     ,     , 0.00,     0.00,     0.00,  0.0%,

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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:,            TR061207
User ID:,              MCD 1
Meter name:,           PAA11 std2
Meter id:,             0-00A
Meter type:,           PAA11
Meter Standard:,       SAE
Meter Revs/Pulses:,   1/1
Meter Const.S1:,      2.2048
Meter Const.O1:,      0.0178
Meter Const.C1:,      0.0000
Meter Const.S2:,      0.0000
Meter Const.O2:,      0.0000
Meter Const.C1:,      0.0000
Meter Const.S3:,      0.0000
Meter Const.O3:,      0.0000
Beg Time:,           12/07/06 09:19
End Time:,           12/07/06 10:37
Meas Time:,           1.30
Section Diff:,      227.88
Beg Gage height:,     4.46
End Gage height:,     4.47
Beg Staff height:,    4.66
End Staff height:,    4.64
Estimated Q:,      1600.00
Adjusted  Q:,      1830.00
Measure time:,       40
Measure standard:,     SAE
Measure equipment:,    Susp.Cable
Sounding Weight:,      C30  0.50
Measure ice:,          No
Flood Measurement:,    No
Flood Coef:,          0.00
Max Vertical Q:,      5%
Percent Slope:,       0.0000
Measure Start at:,     LEW No
Vertical Count:,     27
Section Velocity:,    0.90
Section Width:,     290.00
Section Area:,     2027.40
Section Q:,        1827.88
Section Diff:,      227.88
Section Pct Err:,    14.2%
Section Quality:,      na
Section WetPerim:,  292.71
Section Hyd Rad:,     6.93
Section Manning:,     0.0000
Section Chezy:,       0.0000

VERT,   DIST,TDPTH,IDRFT,EDPTH,OBS,  TIME,REVS,HA,HC:VF,METH,CLOCK, MVEL, OVEL, VVEL,   SSAREA,      SSQ,SSPCT,
FLAGS
 1,    95.00, 0.00, 0.00, 0.00,  E,      ,    ,  ,     ,    ,09:19,      ,      , 0.00,     0.00,     0.00,  0.0%,
 2,   110.00, 2.50, 0.00, 2.50, o6,40.09,   4, 0, 1.00,1.00,09:21, 0.24, 0.24, 0.24,    75.00,    17.83,  1.0%,
 3,   155.00, 8.10, 0.00, 8.10, o2,40.23,  10, 0, 1.00,1.00,09:25, 0.57, 0.57
 3,   155.00, 8.10, 0.00, 8.10, o8,44.37,   9, 0, 1.00,1.00,09:24, 0.47, 0.47, 0.52,   202.50,   104.38,  5.7%,
 4,   160.00, 8.40, 0.00, 8.40, o2,41.40,  14, 0, 1.00,1.00,09:28, 0.76, 0.76
 4,   160.00, 8.40, 0.00, 8.40, o8,42.19,  11, 0, 1.00,1.00,09:27, 0.59, 0.59, 0.68,    84.00,    56.95,  3.1%,
 5,   175.00, 8.00, 0.00, 8.00, o2,42.60,  17, 0, 1.00,1.00,09:31, 0.90, 0.90
 5,   175.00, 8.00, 0.00, 8.00, o8,42.71,  12, 0, 1.00,1.00,09:30, 0.64, 0.64, 0.77,   100.00,    76.75,  4.2%,
 6,   185.00, 7.80, 0.00, 7.80, o2,40.56,  17, 0, 1.00,1.00,09:33, 0.94, 0.94
 6,   185.00, 7.80, 0.00, 7.80, o8,43.33,  14, 0, 1.00,1.00,09:32, 0.73, 0.73, 0.84,    93.60,    78.25,  4.3%,
 7,   199.00, 7.70, 0.00, 7.70, o2,41.16,  20, 0, 1.00,1.00,09:37, 1.09, 1.09
 7,   199.00, 7.70, 0.00, 7.70, o8,42.08,  16, 0, 1.00,1.00,09:36, 0.86, 0.86, 0.97,    80.85,    78.64,  4.3%,
 8,   206.00, 7.40, 0.00, 7.40, o2,40.66,  20, 0, 1.00,1.00,09:40, 1.10, 1.10
 8,   206.00, 7.40, 0.00, 7.40, o8,41.49,  17, 0, 1.00,1.00,09:39, 0.92, 0.92, 1.01,    70.30,    71.13,  3.9%,
 9,   218.00, 6.00, 0.00, 6.00, o2,41.42,  21, 0, 1.00,1.00,09:43, 1.14, 1.14
 9,   218.00, 6.00, 0.00, 6.00, o8,40.49,  15, 0, 1.00,1.00,09:42, 0.83, 0.83, 0.99,    72.00,    70.93,  3.9%,
10,   230.00, 6.00, 0.00, 6.00, o2,40.38,  17, 0, 1.00,1.00,09:46, 0.95, 0.95
10,   230.00, 6.00, 0.00, 6.00, o8,41.39,  14, 0, 1.00,1.00,09:45, 0.76, 0.76, 0.85,    81.00,    69.24,  3.8%,
11,   245.00, 9.50, 0.00, 9.50, o2,40.79,  25, 0, 1.00,1.00,09:49, 1.37, 1.37
11,   245.00, 9.50, 0.00, 9.50, o8,40.08,  17, 0, 1.00,1.00,09:48, 0.95, 0.95, 1.16,    95.00,   110.30,  6.0%,
12,   250.00, 9.20, 0.00, 9.20, o2,40.69,  26, 0, 1.00,1.00,09:52, 1.43, 1.43
12,   250.00, 9.20, 0.00, 9.20, o8,41.54,  22, 0, 1.00,1.00,09:51, 1.19, 1.19, 1.31,    59.80,    78.10,  4.3%,
13,   258.00, 9.00, 0.00, 9.00, o2,40.05,  26, 0, 1.00,1.00,09:55, 1.45, 1.45
13,   258.00, 9.00, 0.00, 9.00, o8,40.96,  18, 0, 1.00,1.00,09:54, 0.99, 0.99, 1.22,    63.00,    76.73,  4.2%,
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14,   264.00, 9.20, 0.00, 9.20, o2,40.84,  26, 0, 1.00,1.00,09:57, 1.42, 1.42
14,   264.00, 9.20, 0.00, 9.20, o8,40.52,  21, 0, 1.00,1.00,09:56, 1.16, 1.16, 1.29,    59.80,    77.20,  4.2%,
15,   271.00, 9.20, 0.00, 9.20, o2,40.16,  25, 0, 1.00,1.00,10:00, 1.39, 1.39
15,   271.00, 9.20, 0.00, 9.20, o8,41.84,  19, 0, 1.00,1.00,09:59, 1.02, 1.02, 1.20,    64.40,    77.58,  4.2%,
16,   278.00, 8.80, 0.00, 8.80, o2,40.33,  25, 0, 1.00,1.00,10:08, 1.38, 1.38
16,   278.00, 8.80, 0.00, 8.80, o8,42.10,  21, 0, 1.00,1.00,10:07, 1.12, 1.12, 1.25,    61.60,    77.06,  4.2%,
17,   285.00, 8.00, 0.00, 8.00, o2,40.87,  26, 0, 1.00,1.00,10:11, 1.42, 1.42
17,   285.00, 8.00, 0.00, 8.00, o8,40.37,  19, 0, 1.00,1.00,10:10, 1.06, 1.06, 1.24,    64.00,    79.23,  4.3%,
18,   294.00, 8.10, 0.00, 8.10, o2,41.69,  23, 0, 1.00,1.00,10:14, 1.23, 1.23
18,   294.00, 8.10, 0.00, 8.10, o8,40.87,  18, 0, 1.00,1.00,10:13, 0.99, 0.99, 1.11,    68.85,    76.53,  4.2%,
19,   302.00, 8.50, 0.00, 8.50, o2,41.60,  26, 0, 1.00,1.00,10:16, 1.40, 1.40
19,   302.00, 8.50, 0.00, 8.50, o8,41.37,  13, 0, 1.00,1.00,10:15, 0.71, 0.71, 1.05,    72.25,    76.09,  4.2%,
20,   311.00, 8.50, 0.00, 8.50, o2,41.38,  15, 0, 1.00,1.00,10:19, 0.82, 0.82
20,   311.00, 8.50, 0.00, 8.50, o8,42.21,  15, 0, 1.00,1.00,10:18, 0.80, 0.80, 0.81,    93.50,    75.66,  4.1%,
21,   324.00,10.40, 0.00,10.40, o2,40.39,  19, 0, 1.00,1.00,10:22, 1.05, 1.05
21,   324.00,10.40, 0.00,10.40, o8,41.15,  16, 0, 1.00,1.00,10:21, 0.88, 0.88, 0.97,    98.80,    95.34,  5.2%,
22,   330.00, 9.80, 0.00, 9.80, o2,40.81,  20, 0, 1.00,1.00,10:25, 1.10, 1.10
22,   330.00, 9.80, 0.00, 9.80, o8,40.36,  12, 0, 1.00,1.00,10:24, 0.67, 0.67, 0.89,    78.40,    69.45,  3.8%,
23,   340.00, 7.50, 0.00, 7.50, o2,40.33,  18, 0, 1.00,1.00,10:27, 1.00, 1.00
23,   340.00, 7.50, 0.00, 7.50, o8,41.56,  16, 0, 1.00,1.00,10:26, 0.87, 0.87, 0.93,    82.50,    77.07,  4.2%,
24,   352.00, 7.40, 0.00, 7.40, o2,41.06,  16, 0, 1.00,1.00,10:31, 0.88, 0.88
24,   352.00, 7.40, 0.00, 7.40, o8,41.65,  12, 0, 1.00,1.00,10:29, 0.65, 0.65, 0.76,    96.20,    73.59,  4.0%,
25,   366.00, 6.60, 0.00, 6.60, o2,41.22,  16, 0, 1.00,1.00,10:33, 0.87, 0.87
25,   366.00, 6.60, 0.00, 6.60, o8,41.54,  13, 0, 1.00,1.00,10:32, 0.71, 0.71, 0.79,    82.50,    65.23,  3.6%,
26,   377.00, 2.90, 0.00, 2.90, o2,42.05,  13, 0, 1.00,1.00,10:36, 0.70, 0.70
26,   377.00, 2.90, 0.00, 2.90, o8,41.71,  12, 0, 1.00,1.00,10:35, 0.65, 0.65, 0.68,    27.55,    18.62,  1.0%,
27,   385.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,10:36,     ,     , 0.00,     0.00,     0.00,  0.0%,
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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:,            TR070220
User ID:,              MCD 1
Meter name:,           PAA11 std2
Meter id:,             0-00A
Meter type:,           PAA11
Meter Standard:,       SAE
Meter Revs/Pulses:,   1/1
Meter Const.S1:,      2.2048
Meter Const.O1:,      0.0178
Meter Const.C1:,      0.0000
Meter Const.S2:,      0.0000
Meter Const.O2:,      0.0000
Meter Const.C1:,      0.0000
Meter Const.S3:,      0.0000
Meter Const.O3:,      0.0000
Beg Time:,           02/20/07 10:53
End Time:,           02/20/07 11:31
Meas Time:,           0.63
Section Diff:,        4.07
Beg Gage height:,     2.73
End Gage height:,     0.00
Beg Staff height:,    2.71
End Staff height:,    0.00
Estimated Q:,       400.00
Adjusted  Q:,       400.00
Measure time:,       40
Measure standard:,     SAE
Measure equipment:,    TopSet Rod
Sounding Weight:,      NA
Measure ice:,          No
Flood Measurement:,    No
Flood Coef:,          0.00
Max Vertical Q:,      5%
Percent Slope:,       0.0000
Measure Start at:,     LEW No
Vertical Count:,     26
Section Velocity:,    2.52
Section Width:,     134.00
Section Area:,      160.34
Section Q:,         404.07
Section Diff:,        4.07
Section Pct Err:,     1.0%
Section Quality:,      na
Section WetPerim:,  134.12
Section Hyd Rad:,     1.20
Section Manning:,     0.0000
Section Chezy:,       0.0000

VERT,   DIST,TDPTH,IDRFT,EDPTH,OBS,  TIME,REVS,HA,HC:VF,METH,CLOCK, MVEL, OVEL, VVEL,   SSAREA,      SSQ,SSPCT,
FLAGS
 1,    10.00, 0.00, 0.00, 0.00,  E,      ,     ,  ,     ,     ,10:53,      ,      , 0.00,     0.00,     0.00,  0.0%,
 2,    15.00, 0.50, 0.00, 0.50, o6,41.28,  23, 8, 0.99,1.00,10:55, 1.25, 1.23, 1.23,     3.50,     4.32,  1.1%,
 3,    24.00, 0.72, 0.00, 0.72, o6,40.02,  36,16, 0.96,1.00,10:57, 2.00, 1.92, 1.92,     6.84,    13.14,  3.3%,
 4,    34.00, 0.72, 0.00, 0.72, o6,40.21,  40, 8, 0.99,1.00,10:59, 2.21, 2.19, 2.19,     6.48,    14.18,  3.5%,
 5,    42.00, 1.28, 0.00, 1.28, o6,40.00,  43, 0, 1.00,1.00,11:01, 2.39, 2.39, 2.39,     8.32,    19.87,  4.9%,
 6,    47.00, 1.45, 0.00, 1.45, o6,40.50,  52, 0, 1.00,1.00,11:02, 2.85, 2.85, 2.85,     6.52,    18.59,  4.6%,
 7,    51.00, 1.45, 0.00, 1.45, o6,40.09,  57, 8, 0.99,1.00,11:04, 3.15, 3.12, 3.12,     5.80,    18.10,  4.5%,
 8,    55.00, 1.57, 0.00, 1.57, o6,40.05,  56,11, 0.98,1.00,11:06, 3.10, 3.04, 3.04,     6.28,    19.08,  4.7%,
 9,    59.00, 1.65, 0.00, 1.65, o6,40.28,  58,16, 0.96,1.00,11:07, 3.19, 3.06, 3.06,     6.19,    18.96,  4.7%,
10,    62.50, 1.80, 0.00, 1.80, o6,40.49,  55,18, 0.95,1.00,11:09, 3.01, 2.86, 2.86,     6.30,    18.03,  4.5%,
11,    66.00, 1.98, 0.00, 1.98, o6,40.44,  57,16, 0.96,1.00,11:12, 3.13, 3.00, 3.00,     6.43,    19.31,  4.8%,
12,    69.00, 2.03, 0.00, 2.03, o6,40.43,  60,16, 0.96,1.00,11:13, 3.29, 3.16, 3.16,     6.09,    19.23,  4.8%,
13,    72.00, 2.04, 0.00, 2.04, o6,40.44,  59,16, 0.96,1.00,11:14, 3.23, 3.11, 3.11,     6.12,    19.00,  4.7%,
14,    75.00, 2.00, 0.00, 2.00, o6,40.30,  58,16, 0.96,1.00,11:15, 3.19, 3.06, 3.06,     6.00,    18.38,  4.5%,
15,    78.00, 1.85, 0.00, 1.85, o6,40.52,  61,20, 0.94,1.00,11:17, 3.34, 3.14, 3.14,     6.47,    20.31,  5.0%,
16,    82.00, 1.57, 0.00, 1.57, o6,40.65,  58,20, 0.94,1.00,11:18, 3.16, 2.97, 2.97,     6.28,    18.68,  4.6%,
17,    86.00, 1.55, 0.00, 1.55, o6,40.25,  52,23, 0.92,1.00,11:19, 2.87, 2.64, 2.64,     6.97,    18.39,  4.6%,
18,    91.00, 1.53, 0.00, 1.53, o6,40.58,  52,23, 0.92,1.00,11:21, 2.84, 2.62, 2.62,     7.65,    20.01,  5.0%,
19,    96.00, 1.53, 0.00, 1.53, o6,40.59,  45,23, 0.92,1.00,11:22, 2.46, 2.27, 2.27,     8.41,    19.06,  4.7%,
20,   102.00, 1.40, 0.00, 1.40, o6,40.53,  42,20, 0.94,1.00,11:24, 2.30, 2.16, 2.16,     8.40,    18.18,  4.5%,
21,   108.00, 1.43, 0.00, 1.43, o6,40.72,  40, 8, 0.99,1.00,11:25, 2.18, 2.16, 2.16,     9.30,    20.09,  5.0%,
22,   115.00, 1.15, 0.00, 1.15, o6,40.32,  40, 0, 1.00,1.00,11:26, 2.21, 2.21, 2.21,     8.63,    19.02,  4.7%,
23,   123.00, 0.93, 0.00, 0.93, o6,40.45,  36, 8, 0.99,1.00,11:28, 1.98, 1.96, 1.96,     7.91,    15.50,  3.8%,
24,   132.00, 0.80, 0.00, 0.80, o6,40.52,  33, 0, 1.00,1.00,11:30, 1.81, 1.81, 1.81,     6.80,    12.33,  3.1%,
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25,   140.00, 0.44, 0.00, 0.44, o6,41.23,  16, 0, 1.00,1.00,11:31, 0.87, 0.87, 0.87,     2.64,     2.31,  0.6%,
26,   144.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,11:31,     ,     , 0.00,     0.00,     0.00,  0.0%,
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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR070409
User ID:, MCD 1
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 04/09/07 09:56
End Time:, 04/09/07 10:31
Meas Time:, 0.58
Section Diff:, 27.18
Beg Gage height:, 3.18
End Gage height:, 3.16
Beg Staff height:, 3.17
End Staff height:, 3.17
Estimated Q:, 725.00
Adjusted Q:, 752.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 27
Section Velocity:, 3.33
Section Width:, 159.00
Section Area:, 226.07
Section Q:, 752.18
Section Diff:, 27.18
Section Pct Err:, 3.7%
Section Quality:, na
Section WetPerim:, 159.15
Section Hyd Rad:, 1.42
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT	DIST	TDPTH	IDRFT	EDPTH	OBS	TIME	REVS	HA	HC:VF	METH	CLOCK	MVEL	OVEL	VVEL	SSAREA	SSQ	SSPCT	FLAGS
1	1.00	0.00	0.00	0.00	E						09:56			0.00	0.00	0.00	0.0%	
2	5.00	0.60	0.00	0.60	o6	41.52	16,14	0.97	1.00	09	58	0.87	0.84	0.84	3.90	3.28	0.4%	
3	14.00	0.75	0.00	0.75	o6	41.49	22,14	0.97	1.00	09	59	1.19	1.15	1.15	6.38	7.34	1.0%	
4	22.00	1.12	0.00	1.12	o6	40.31	63,11	0.98	1.00	10	01	3.46	3.39	3.39	8.96	30.41	4.0%	
5	30.00	1.06	0.00	1.06	o6	40.26	61,11	0.98	1.00	10	02	3.36	3.29	3.29	8.48	27.91	3.7%	
6	38.00	1.06	0.00	1.06	o6	40.14	66, 8	0.99	1.00	10	03	3.64	3.61	3.61	7.95	28.67	3.8%	
7	45.00	1.45	0.00	1.45	o6	40.02	71, 8	0.99	1.00	10	05	3.93	3.89	3.89	9.42	36.66	4.9%	
8	51.00	1.74	0.00	1.74	o6	40.17	68, 0	1.00	1.00	10	06	3.75	3.75	3.75	9.57	35.89	4.8%	
9	56.00	1.70	0.00	1.70	o6	40.43	77, 0	1.00	1.00	10	07	4.22	4.22	4.22	8.50	35.84	4.8%	
10	61.00	1.97	0.00	1.97	o6	40.05	81, 8	0.99	1.00	10	09	4.48	4.43	4.43	7.88	34.93	4.6%	
11	64.00	1.93	0.00	1.93	o6	40.04	82, 8	0.99	1.00	10	10	4.53	4.49	4.49	6.75	30.32	4.0%	
12	68.00	2.15	0.00	2.15	o6	40.41	82, 8	0.99	1.00	10	11	4.49	4.45	4.45	7.52	33.46	4.4%	
13	71.00	2.25	0.00	2.25	o6	40.34	83, 8	0.99	1.00	10	13	4.55	4.51	4.51	7.88	35.51	4.7%	
14	75.00	2.32	0.00	2.32	o6	40.00	77,11	0.98	1.00	10	14	4.26	4.18	4.18	8.12	33.92	4.5%	
15	78.00	2.40	0.00	2.40	o6	40.57	76,11	0.98	1.00	10	15	4.15	4.07	4.07	8.40	34.15	4.5%	
16	82.00	2.28	0.00	2.28	o6	40.34	71,11	0.98	1.00	10	17	3.90	3.82	3.82	9.12	34.84	4.6%	
17	86.00	1.95	0.00	1.95	o6	40.36	70,14	0.97	1.00	10	18	3.84	3.73	3.73	9.75	36.33	4.8%	
18	92.00	1.93	0.00	1.93	o6	40.43	65,14	0.97	1.00	10	19	3.56	3.46	3.46	10.61	36.68	4.9%	
19	97.00	1.96	0.00	1.96	o6	40.04	60,14	0.97	1.00	10	21	3.32	3.22	3.22	10.78	34.73	4.6%	
20	103.00	1.86	0.00	1.86	o6	40.62	57,14	0.97	1.00	10	22	3.11	3.02	3.02	12.09	36.49	4.9%	
21	110.00	1.78	0.00	1.78	o6	40.53	55, 0	1.00	1.00	10	23	3.01	3.01	3.01	11.57	34.82	4.6%	
22	116.00	1.75	0.00	1.75	o6	40.06	55, 0	1.00	1.00	10	25	3.04	3.04	3.04	11.38	34.64	4.6%	
23	123.00	1.48	0.00	1.48	o6	40.32	53, 0	1.00	1.00	10	26	2.92	2.92	2.92	11.84	34.53	4.6%	
24	132.00	1.27	0.00	1.27	o6	40.11	50, 8	0.99	1.00	10	27	2.77	2.74	2.74	12.06	33.04	4.4%	

```
25,   142.00, 1.13, 0.00, 1.13, o6,40.84,  40,11, 0.98,1.00,10:29, 2.18, 2.13, 2.13,    11.30,    24.11,  3.2%,
26,   152.00, 0.65, 0.00, 0.65, o6,41.96,  12,14, 0.97,1.00,10:30, 0.65, 0.63, 0.63,     5.85,     3.68,  0.5%,
27,   160.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,10:31,     ,     , 0.00,     0.00,     0.00,  0.0%,

→
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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR070626
User ID:, MCD 1
Meter name:, PAA11 std2
Meter id:, 0-00A
Meter type:, PAA11
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 2.2048
Meter Const.O1:, 0.0178
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 06/26/07 08:50
End Time:, 06/26/07 09:24
Meas Time:, 0.57
Section Diff:, -30.56
Beg Gage height:, 0.00
End Gage height:, 0.00
Beg Staff height:, 2.36
End Staff height:, 0.00
Estimated Q:, 214.00
Adjusted Q:, 214.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 23
Section Velocity:, 1.28
Section Width:, 85.00
Section Area:, 143.47
Section Q:, 183.44
Section Diff:, -30.56
Section Pct Err:, -14.3%
Section Quality:, na
Section WetPerim:, 85.50
Section Hyd Rad:, 1.68
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT	DIST	TDPTH	IDRFT	EDPTH	OBS	TIME	REVS	HA	HC:VF	METH	CLOCK	MVEL	OVEL	VVEL	SSAREA	SSQ	SSPCT	FLAGS
1	2.00	0.00	0.00	0.00	E						08:50			0.00	0.00	0.00	0.0%	
2	7.00	1.57	0.00	1.57	o6	43.62	4	0	1.00	1.00	08:53	0.22	0.22	0.22	8.63	1.90	1.0%	
3	13.00	2.00	0.00	2.00	o6	40.08	18	8	0.99	1.00	08:54	1.01	1.00	1.00	11.00	10.98	6.0%	
4	18.00	2.27	0.00	2.27	o6	40.90	28	8	0.99	1.00	08:55	1.53	1.51	1.51	7.95	12.01	6.5%	
5	20.00	2.20	0.00	2.20	o6	41.74	30	8	0.99	1.00	08:57	1.60	1.59	1.59	5.50	8.73	4.8%	
6	23.00	1.94	0.00	1.94	o6	41.11	31	0	1.00	1.00	08:59	1.68	1.68	1.68	5.82	9.78	5.3%	
7	26.00	1.63	0.00	1.63	o6	41.17	35	0	1.00	1.00	09:01	1.89	1.89	1.89	5.70	10.79	5.9%	
8	30.00	1.60	0.00	1.60	o6	40.51	27	0	1.00	1.00	09:02	1.49	1.49	1.49	7.20	10.71	5.8%	
9	35.00	1.55	0.00	1.55	o6	40.65	26	0	1.00	1.00	09:04	1.43	1.43	1.43	6.97	9.96	5.4%	
10	39.00	1.73	0.00	1.73	o6	40.82	24	0	1.00	1.00	09:05	1.31	1.31	1.31	6.92	9.09	5.0%	
11	43.00	1.73	0.00	1.73	o6	40.10	36	0	1.00	1.00	09:07	2.00	2.00	2.00	5.19	10.37	5.7%	
12	45.00	1.85	0.00	1.85	o6	40.73	32	0	1.00	1.00	09:08	1.75	1.75	1.75	4.63	8.09	4.4%	
13	48.00	1.85	0.00	1.85	o6	40.77	43	0	1.00	1.00	09:09	2.34	2.34	2.34	4.63	10.84	5.9%	
14	50.00	1.80	0.00	1.80	o6	41.13	37	0	1.00	1.00	09:10	2.00	2.00	2.00	4.50	9.01	4.9%	
15	53.00	1.77	0.00	1.77	o6	40.77	35	8	0.99	1.00	09:13	1.91	1.89	1.89	5.31	10.04	5.5%	
16	56.00	1.99	0.00	1.99	o6	40.17	30	0	1.00	1.00	09:14	1.66	1.66	1.66	5.97	9.94	5.4%	
17	59.00	1.99	0.00	1.99	o6	40.68	31	0	1.00	1.00	09:16	1.70	1.70	1.70	5.97	10.14	5.5%	
18	62.00	1.98	0.00	1.98	o6	40.04	29	0	1.00	1.00	09:17	1.61	1.61	1.61	5.94	9.59	5.2%	
19	65.00	1.80	0.00	1.80	o6	40.38	26	0	1.00	1.00	09:18	1.44	1.44	1.44	5.40	7.76	4.2%	
20	68.00	1.85	0.00	1.85	o6	42.37	21	0	1.00	1.00	09:19	1.11	1.11	1.11	7.40	8.22	4.5%	
21	73.00	1.94	0.00	1.94	o6	49.49	6	0	1.00	1.00	09:21	0.29	0.29	0.29	11.64	3.32	1.8%	
22	80.00	1.60	0.00	1.60	o6	50.08	4	0	1.00	1.00	09:23	0.19	0.19	0.19	11.20	2.17	1.2%	
23	87.00	0.00	0.00	0.00	E						09:24			0.00	0.00	0.00	0.0%	

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<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,000000C2949C
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:,            TR070801
User ID:,              MCD 2
Meter name:,           PYGMY std2
Meter id:,             0-00B
Meter type:,           PYGMY
Meter Standard:,       SAE
Meter Revs/Pulses:,   1/1
Meter Const.S1:,      0.9604
Meter Const.O1:,      0.0312
Meter Const.C1:,      0.0000
Meter Const.S2:,      0.0000
Meter Const.O2:,      0.0000
Meter Const.C1:,      0.0000
Meter Const.S3:,      0.0000
Meter Const.O3:,      0.0000
Beg Time:,           08/01/07 09:23
End Time:,           08/01/07 10:04
Meas Time:,           0.68
Section Diff:,      -16.71
Beg Gage height:,     2.05
End Gage height:,     2.05
Beg Staff height:,    2.07
End Staff height:,    2.07
Estimated Q:,       115.00
Adjusted  Q:,        98.30
Measure time:,       40
Measure standard:,     SAE
Measure equipment:,    TopSet Rod
Sounding Weight:,      NA
Measure ice:,          No
Flood Measurement:,    No
Flood Coef:,          0.00
Max Vertical Q:,      5%
Percent Slope:,       0.0000
Measure Start at:,     LEW No
Vertical Count:,     23
Section Velocity:,    2.09
Section Width:,      53.00
Section Area:,       46.98
Section Q:,          98.29
Section Diff:,      -16.71
Section Pct Err:,   -14.5%
Section Quality:,      na
Section WetPerim:,   53.15
Section Hyd Rad:,     0.88
Section Manning:,     0.0000
Section Chezy:,       0.0000

VERT,   DIST,TDPTH,IDRFT,EDPTH,OBS,  TIME,REVS,HA,HC:VF,METH,CLOCK, MVEL, OVEL, VVEL,   SSAREA,      SSQ,SSPCT,
FLAGS
 1,     4.00, 0.00, 0.00, 0.00,  E,      ,     ,  ,     ,     ,09:23,      ,      , 0.00,     0.00,     0.00,  0.0%,
 2,    10.00, 0.39, 0.00, 0.39, o6,41.36,  32, 0, 1.00,1.00,09:24, 0.77, 0.77, 0.77,     1.95,     1.51,  1.5%,
 3,    14.00, 0.55, 0.00, 0.55, o6,40.20,  44, 0, 1.00,1.00,09:26, 1.08, 1.08, 1.08,     2.20,     2.38,  2.4%,
 4,    18.00, 0.86, 0.00, 0.86, o6,40.69,  67, 0, 1.00,1.00,09:27, 1.61, 1.61, 1.61,     3.44,     5.55,  5.6%,
 5,    22.00, 1.03, 0.00, 1.03, o6,40.29,  77, 8, 0.99,1.00,09:29, 1.87, 1.85, 1.85,     3.09,     5.71,  5.8%,
 6,    24.00, 1.04, 0.00, 1.04, o6,40.15,  98, 8, 0.99,1.00,09:32, 2.38, 2.35, 2.35,     2.08,     4.89,  5.0%,
 7,    26.00, 1.34, 0.00, 1.34, o6,40.34, 101, 8, 0.99,1.00,09:34, 2.44, 2.41, 2.41,     2.34,     5.65,  5.7%,
 8,    27.50, 1.35, 0.00, 1.35, o6,40.25,  97, 8, 0.99,1.00,09:35, 2.35, 2.32, 2.32,     2.36,     5.49,  5.6%,
 9,    29.50, 1.34, 0.00, 1.34, o6,40.17, 122,11, 0.98,1.00,09:37, 2.95, 2.89, 2.89,     2.01,     5.81,  5.9%,
10,    30.50, 1.38, 0.00, 1.38, o6,40.18, 113, 8, 0.99,1.00,09:40, 2.73, 2.70, 2.70,     2.07,     5.60,  5.7%,
11,    32.50, 1.31, 0.00, 1.31, o6,40.22,  90, 8, 0.99,1.00,09:41, 2.18, 2.16, 2.16,     2.62,     5.66,  5.8%,
12,    34.50, 1.40, 0.00, 1.40, o6,40.33, 115, 8, 0.99,1.00,09:44, 2.77, 2.74, 2.74,     2.10,     5.76,  5.9%,
13,    35.50, 1.37, 0.00, 1.37, o6,40.12, 107, 8, 0.99,1.00,09:45, 2.59, 2.57, 2.57,     2.06,     5.27,  5.4%,
14,    37.50, 1.47, 0.00, 1.47, o6,40.20, 111, 8, 0.99,1.00,09:48, 2.68, 2.66, 2.66,     1.84,     4.88,  5.0%,
15,    38.00, 1.48, 0.00, 1.48, o6,40.28, 110, 8, 0.99,1.00,09:50, 2.65, 2.63, 2.63,     1.85,     4.86,  4.9%,
16,    40.00, 1.49, 0.00, 1.49, o6,40.08, 104, 0, 1.00,1.00,09:52, 2.52, 2.52, 2.52,     2.24,     5.64,  5.7%,
17,    41.00, 1.42, 0.00, 1.42, o6,40.26, 101, 0, 1.00,1.00,09:53, 2.44, 2.44, 2.44,     2.13,     5.20,  5.3%,
18,    43.00, 1.40, 0.00, 1.40, o6,40.05,  93, 0, 1.00,1.00,09:55, 2.26, 2.26, 2.26,     2.45,     5.54,  5.6%,
19,    44.50, 1.37, 0.00, 1.37, o6,40.02,  80, 0, 1.00,1.00,09:56, 1.95, 1.95, 1.95,     2.74,     5.35,  5.4%,
20,    47.00, 0.98, 0.00, 0.98, o6,40.31,  73, 0, 1.00,1.00,09:58, 1.77, 1.77, 1.77,     2.69,     4.77,  4.9%,
21,    50.00, 0.53, 0.00, 0.53, o6,40.57,  52,16, 0.96,1.00,10:01, 1.26, 1.21, 1.21,     1.99,     2.41,  2.5%,
22,    54.50, 0.21, 0.00, 0.21, o6,42.09,  20, 0, 1.00,1.00,10:04, 0.49, 0.49, 0.49,     0.73,     0.36,  0.4%,
23,    57.00, 0.00, 0.00, 0.00,  E,     ,    ,  ,     ,    ,10:04,     ,      , 0.00,     0.00,     0.00,  0.0%,
```

<csv>
AquaCalc Pro (tm) by JBS Instruments (c)2002

S/N:,00000084D2EC
Firmware Version:, AQP-1V1.1.3
File Version:, V1.5

Gage ID:, TR070919
User ID:, MCD 1
Meter name:, PYGMY std2
Meter id:, 0-00B
Meter type:, PYGMY
Meter Standard:, SAE
Meter Revs/Pulses:, 1/1
Meter Const.S1:, 0.9604
Meter Const.O1:, 0.0312
Meter Const.C1:, 0.0000
Meter Const.S2:, 0.0000
Meter Const.O2:, 0.0000
Meter Const.C1:, 0.0000
Meter Const.S3:, 0.0000
Meter Const.O3:, 0.0000
Beg Time:, 09/19/07 14:10
End Time:, 09/19/07 14:51
Meas Time:, 0.68
Section Diff:, -11.99
Beg Gage height:, 2.04
End Gage height:, 2.04
Beg Staff height:, 2.04
End Staff height:, 2.04
Estimated Q:, 100.00
Adjusted Q:, 88.00
Measure time:, 40
Measure standard:, SAE
Measure equipment:, TopSet Rod
Sounding Weight:, NA
Measure ice:, No
Flood Measurement:, No
Flood Coef:, 0.00
Max Vertical Q:, 5%
Percent Slope:, 0.0000
Measure Start at:, LEW No
Vertical Count:, 22
Section Velocity:, 1.75
Section Width:, 51.00
Section Area:, 50.19
Section Q:, 88.01
Section Diff:, -11.99
Section Pct Err:, -12.0%
Section Quality:, na
Section WetPerim:, 51.15
Section Hyd Rad:, 0.98
Section Manning:, 0.0000
Section Chezy:, 0.0000

VERT,	DIST,	TDPTH,	IDRFT,	EDPTH,	OBS,	TIME,	REVS,	HA,	HC:VF,	METH,	CLOCK,	MVEL,	OVEL,	VVEL,	SSAREA,	SSQ,	SSPCT,	FLAGS
1,	4.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	,14:10,	,	,	0.00,	0.00,	0.00,	0.0%,	
2,	8.00,	0.42,	0.00,	0.42,	o6,40.63,	14,	8,	0.99,	1.00,	14:12,	0.36,	0.36,	0.36,	1.89,	0.68,	0.8%,		
3,	13.00,	0.80,	0.00,	0.80,	o6,40.04,	45,	8,	0.99,	1.00,	14:15,	1.11,	1.10,	1.10,	4.00,	4.40,	5.0%,		
4,	18.00,	0.85,	0.00,	0.85,	o6,40.86,	68,	8,	0.99,	1.00,	14:18,	1.63,	1.61,	1.61,	2.97,	4.80,	5.5%,		
5,	20.00,	1.00,	0.00,	1.00,	o6,40.08,	53,	8,	0.99,	1.00,	14:20,	1.30,	1.29,	1.29,	2.50,	3.22,	3.7%,		
6,	23.00,	1.22,	0.00,	1.22,	o6,40.22,	72,	0,	1.00,	1.00,	14:23,	1.75,	1.75,	1.75,	3.05,	5.34,	6.1%,		
7,	25.00,	1.37,	0.00,	1.37,	o6,40.20,	88,	0,	1.00,	1.00,	14:25,	2.13,	2.13,	2.13,	2.40,	5.12,	5.8%,		
8,	26.50,	1.36,	0.00,	1.36,	o6,40.38,	83,	0,	1.00,	1.00,	14:28,	2.01,	2.01,	2.01,	2.38,	4.77,	5.4%,		
9,	28.50,	1.40,	0.00,	1.40,	o6,40.01,	108,	0,	1.00,	1.00,	14:29,	2.62,	2.62,	2.62,	2.10,	5.51,	6.3%,		
10,	29.50,	1.44,	0.00,	1.44,	o6,40.03,	107,	0,	1.00,	1.00,	14:31,	2.60,	2.60,	2.60,	1.80,	4.68,	5.3%,		
11,	31.00,	1.47,	0.00,	1.47,	o6,40.24,	96,	0,	1.00,	1.00,	14:33,	2.32,	2.32,	2.32,	2.20,	5.12,	5.8%,		
12,	32.50,	1.49,	0.00,	1.49,	o6,40.31,	100,	0,	1.00,	1.00,	14:35,	2.41,	2.41,	2.41,	2.24,	5.39,	6.1%,		
13,	34.00,	1.48,	0.00,	1.48,	o6,40.23,	94,	0,	1.00,	1.00,	14:36,	2.28,	2.28,	2.28,	2.22,	5.05,	5.7%,		
14,	35.50,	1.48,	0.00,	1.48,	o6,40.32,	89,	0,	1.00,	1.00,	14:37,	2.15,	2.15,	2.15,	2.22,	4.78,	5.4%,		
15,	37.00,	1.60,	0.00,	1.60,	o2,40.08,	123,	0,	1.00,	1.00,	14:40,	2.98,	2.98						
15,	37.00,	1.60,	0.00,	1.60,	o8,40.46,	67,	0,	1.00,	1.00,	14:39,	1.62,	1.62,	2.30,	2.40,	5.52,	6.3%,		
16,	38.50,	1.43,	0.00,	1.43,	o6,40.36,	89,	0,	1.00,	1.00,	14:43,	2.15,	2.15,	2.15,	2.14,	4.61,	5.2%,		
17,	40.00,	1.32,	0.00,	1.32,	o6,40.66,	81,	0,	1.00,	1.00,	14:44,	1.94,	1.94,	1.94,	2.31,	4.49,	5.1%,		
18,	42.00,	1.33,	0.00,	1.33,	o6,40.18,	67,	0,	1.00,	1.00,	14:45,	1.63,	1.63,	1.63,	2.99,	4.89,	5.6%,		
19,	44.50,	1.20,	0.00,	1.20,	o6,40.55,	70,	8,	0.99,	1.00,	14:48,	1.69,	1.67,	1.67,	3.00,	5.02,	5.7%,		
20,	47.00,	0.94,	0.00,	0.94,	o6,40.25,	49,	8,	0.99,	1.00,	14:49,	1.20,	1.19,	1.19,	3.53,	4.19,	4.8%,		
21,	52.00,	0.46,	0.00,	0.46,	o6,42.88,	9,	0,	1.00,	1.00,	14:51,	0.23,	0.23,	0.23,	1.84,	0.43,	0.5%,		
22,	55.00,	0.00,	0.00,	0.00,	E,	,	,	,	,	,	,14:51,	,	,	0.00,	0.00,	0.00,	0.0%,	